Government of the People's Republic of Bangladesh

Ministry of Water Resources

Bangladesh Water Development Board

Environmental Management Framework (EMF)

COASTAL EMBANKMENT IMPROVEMENT PROJECT PHASE-I PROJECT (CEIP-I)

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Table of Contents

Table of Contents ..... **ii**
List of Tables ..... **vi**
List of Figures ..... **vi**
Abbreviations and Acronyms ..... **vii**
Executive Summary ..... **viii**
Chapter 1: Introduction **1**
1.1 Project Background 1
1.2 Rationale of the Environmental Management Framework (EMF) 2
1.3 Approach and Methodology for Developing the EMF 2
1.4 Structure of the Report 2
Chapter 2: Description of the Proposed Project **4**
2.1 Proposed CEIP project 4
2.2 Description of Project Component 4
2.3 Proposed Interventions of CEIP with Possible Environmental Concern 7
Chapter 3: Environmental Policies, Legal and Administrative Framework **9**
3.1 Relevant Government Policies, Acts, Rules and Strategy 9
3.1.1 Environmental policy, 1992 9
3.1.2 National Environment Management Action Plan, 1995 9
3.1.3 Bangladesh Environmental Conservation Act (ECA), 1995 9
3.1.4 Bangladesh Environmental Conservation Act (ECA), (Amendments) 2010 10
3.1.5 Bangladesh Environmental Conservation Rules (ECR), 1997 10
3.1.6 Bangladesh Environment Court Act, 2010 11
3.1.7 National Water Policy, 1999 11
3.1.8 National Water Management Plan, 2001 (Approved in 2004) 11
3.1.9 Coastal Zone Policy, 2005 12
3.1.10 Coastal Development Strategy, 2006 12
3.1.11 National land use policy (MoL, 2001) 12
3.1.12 National Agriculture Policy, 1999 13
3.1.13 National Fisheries Policy, 1996 13
3.1.14 National Livestock Development Policy, 2007 13
3.1.15 Forestry Acts 13
3.1.16 Forest Act 1927 (Amendment 2000) 14
3.1.17 Private Forest Ordinance (PFO), 1959 14
3.1.18 Private Forest Policy 1994 14
3.1.19 Social Forestry Rules, 2004 and Amendments 15
3.1.20 Standing Orders on Disaster, 2010 15
3.1.21 National Adaptation Programme of Action (NAPA) 15
3.1.22 Bangladesh Climate Change Strategy and Action Plan (BCSAP) 2009 16
3.1.23 The Embankment and Drainage Act, 1952 16
3.1.24 Bangladesh Labor Act, 2006 17
3.1.25 Bangladesh National Building Code, 2006 17
3.2 Implication of GoB Polices, Acts and Rules on CEIP & Classification 18
3.3 Detailed Steps of In Country Environmental Clearance Procedure 18
3.4 World Bank's Environmental Safeguards Policy 19
3.4.1 General Description of World Bank Safeguard Policy 19
3.4.2 OP 4.01 Environmental Assessment 20
3.4.3 OP 4.04: Natural Habitats 20

3.4.4 OP 4.07: Water Resources Management....20
3.4.5 OP 4.11: Physical Cultural Resources....21
3.4.6 OP 4.36: Forests....21
3.4.7 IFC Environmental Health & Safety Guideline....21
3.5 Implications of the World Bank Policies on CEIP & Environmental Category....22
3.6 'Public consultation and disclosure' requirements by World Bank....22
Chapter 4: Environmental and Social Baseline....23
4.1 Introduction....23
4.2 Physical Settings of the Coastal Regions....24
4.2.1 Climate....24
4.2.2 Land Use....25
4.3 State of the Environment....26
4.3.1 Water Resources....26
4.3.2 Morphological condition....27
4.3.3 Sedimentation and Accretion....27
4.3.4 River functionalities and estuary processes....28
4.3.5 Air water and noise quality....28
4.3.6 Soil and Agriculture....30
4.3.7 Fisheries....32
4.3.8 Ecosystems and Biodiversity....34
4.3.9 Mangrove forest....34
4.3.10 Natural Hazards and Disasters....35
4.4 Socio economic conditions....40
4.5 Assessment of Intervention Requirement from Baseline Survey....41
Chapter 5: Analysis of Alternatives....42
5.1 Introduction....42
5.2 No Action Alternative....42
5.2.1 Withstanding Climate Change and Storm Surge....42
5.2.2 Salinity Intrusion....43
5.2.3 Drainage Congestion and Water Logging....44
5.2.4 Surface Water Availability....44
5.2.5 Sedimentation....44
5.2.6 Soil Fertility....44
5.2.7 Agriculture....45
5.2.8 Livestock....45
5.2.9 Fisheries....45
5.2.10 Flora and Fauna....45
5.2.11 Socio-economic Condition....45
5.3 Alternatives Analysis to Be Assessed During Design and Implementation Phase....45
5.3.1 Alignment....45
5.3.2 Drainage Facility....46
5.3.3 Construction Method....46
5.3.4 Sources of Material....46
5.3.5 Disposal of Sludge Material....47
5.3.6 Protective Measures for Reducing Bank/Embankment Erosion....47
5.3.7 Location and Type of Plantation....47
5.3.8 Location for Labor Camps....47
Chapter 6: Possible Environmental Issues with Mitigation Measures & Benefit of the Project....48
6.1 Introduction....48
6.2 Environmental Impacts due to Rehabilitation and Improvement of Polders System....48

6.2.1 Design Issues& Mitigation....48
6.2.2 Impacts during Construction & Mitigation....52
6.2.3 Impacts during Operation & Maintenance phase and Mitigation....57
6.3 Environmental Impacts due to Afforestation....59
6.4 Potential cumulative impacts in the CEIP polder area....61
6.5 Socio-Economic Enhancement....61
Chapter 7 Environmental Management System....62
7.1 Introduction....62
7.2 General Principles of the CEIP....62
7.3 Environmental Assessment & Management Process of CEIP....63
7.4 Classification of Environmental Assessment....65
7.4.1 Environmental Screening....65
7.4.3 Environmental Impact Assessment....66
7.5 Environmental Assessment Process....67
7.6 Selection of Important Environmental and social Components (IESCs), scoping and bounding....71
7.7 Environmental Management Plan (EMP)....77
7.7.2 Mitigation Measures....78
7.7.3 Monitoring Plan....86
7.7.4 Qualitative Spot Checking Indicators....89
7.7.5 Implementation of EMP & Report Requirement....90
7.7.6 Guideline to Incorporate Environmental Management in Bid Document....90
7.7.7 Guideline for Compensation and Contingency Plan during Project Period....91
7.8 Methods for estimating costs and benefits of the impacts and mitigation/enhancement measures....92
7.8.1 Methods for estimating costs of environmental damages....92
7.8.2 Methods for estimating benefits of the direct positive impacts of the project....92
7.9 Cost of implementing EMP and source of funds....93
7.10 Grievance Redress Mechanism....94
7.10.1 Grievance Redress Focal Points....94
7.10.2 Grievance Resolution Process....94
7.10.3 GRM Disclosure, Documentation and Monitoring....96
Chapter 8 Institutional Arrangements and Capacity Building....97
8.2 Environment, Social and Communication (ESC) Unit....97
8.3 Project Construction Supervision Consultant (CS)....99
8.4 Contractor....100
8.5 Monitoring....100
8.6 Capacity Building & Training....100
Chapter 9 Public Consultation and Disclosure....102
9.1 Introduction....102
9.2 Objectives of public consultation and disclosure....102
9.3 Approach and Methodology of Public Consultation....102
9.4 Issues discussed in the Public Consultation Meetings....104
9.5 Findings of the Public Consultation Meetings....104
9.6 Modes of Future Consultations during Implementation....105
9.7 Plan for Consultations....106
9.8 Public Disclosure Requirement....106
References108
Appendix 1: List of Coastal Polders....109
Appendix 2: Common Capture Fisheries Species In Coastal Area Of Bangladesh....112

Appendix 3: Protected areas in the coastal zone of Bangladesh 113
Appendix 4: Common flora and fauna habituating in coastal region of Bangladesh 114
Appendix 5: List Of Polders Likely To Be Overtopped In Baseline And Climate Change Scenario 117
Appendix 6: Environmental Screening Format for Rehabilitation and Construction of Coastal Polder 118
Appendix 7 Environmental Screening Format for Foreshore Afforestation 121
Appendix 8 Terms of Reference for Initial Environmental Examination (IEE) of Sub-Projects under CEIP.....123
Appendix 9 Terms of Reference for Environmental Impact Assessment (EIA) of Sub-Projects under CEIP.....125
Appendix 10: Example Good Environmental Construction Guideline 129
Appendix 11: Participants & Photographs of meeting, workshop and baseline survey 133

List of Tables

Table 2-1: Estimated project cost by component (US$ million)..... 7
Table 4-1: Polders in different zones of coastal area..... 24
Table 4-2 Air Quality in Coastal Area..... 28
Table 4-3: Surface Water Quality In Different Rivers In Coastal Area..... 29
Table 4-4: Ground Water Quality In Different Rivers In Coastal Area..... 29
Table 4-5: Noise Quality In Different Rivers In Coastal Area..... 30
Table 4-6: Improvement works to be done for each type of interventions under CEIP project..... 41
Table 7-1 Impact of Project Activity on IESC..... 73
Table 7.2: Parameters for Determining Magnitude..... 76
Table 7.3: Criteria for Determining Sensitivity..... 77
Table 7.4: Assessment of Potential Impact Significance..... 77
Table 7-4 Generic Mitgation/Compensation Meaqsures/Guideline..... 79
Table 7-5 Environmental Monitoring Plan during Construction and Operation of Rehabilitation and Improvement of Polders System..... 87
Table 7-6 Environmental Monitoring Plan during Construction and Operation of Afforestation..... 89
Table 7-7 Spot Checking Indicator..... 90
Table 7-8: Example of methods for Estimating Costs of Environmental Damages..... 92
Table 7-9: Example of methods for estimating benefits of positive environmental impacts..... 92
Table 7-10: Example of methods for estimating cost and benefits of mitigation/ enhancement measures 93
Table 8-1: Functions and Responsibilities of the ESC..... 98
Table 9-1: Plan for Participatory Consultation during Project Implementation..... 106

List of Figures

Figure 1-1: Methodology of EMF..... 2
Figure 3-1: Process of obtaining Clearance certificate from DoE..... 19
Figure 4-1: Polders in Coastal area of Bangladesh..... 23
Figure 4-2: Climatic Zones of Bangladesh..... 24
Figure 4-3: Land Use Map of Coastal Area..... 25
Figure 4-4: Historical water level in major rivers in coastal zone of Bangladesh..... 26
Figure 4-5: Agricultural Landuse Pattern in Coastal Area..... 31
Figure 4-6: Coastal fish habitats..... 32
Figure 4-7: Important fish species in coastal region..... 33
Figure 4-8 Damaged Coastal Polder 35/1 near Rayenda along Baleswar due to Sidr..... 35
Figure 4-9: Water logging in Polder 10-12, Koyra and Paikgacha, Khulna..... 36
Figure 4-10: Water logging affected areas in coastal zone..... 37
Figure 4-11: Soil salinity (dS/m) in coastal area of Bangladesh in 2009..... 38
Figure 4-12: Surface water salinity (dS/m, maximum in January 2010) distribution in coastal area..... 39
Figure 4-13: Groundwater Studies of Arsenic Contamination in Bangladesh (DPHE/BGS/DFID, 2000) 40
Figure 5-1: Overtopped Polders in Coastal Area Under Different Scenarios (*World Bank, 2010*)..... 43
Figure 5-2: Salinity Condition In Coastal Area (for 2005 and 2050)..... 43
Figure 5-3: Existing Alignment of Polder 35/1 at Khuolia..... 46
Figure 7-1Environmental Assessment & Management Process for CEIP..... 65
Figure 7-2 Framework for Preparation of EMP during Construction and O&M (MRDI, 2011)..... 78
Figure 7-3 GRM Process Flow Chart..... 95
Figure 8-1 BWDB Institutional Arrangement for CEIP Implementation..... 97

Abbreviations and Acronyms

BWDB	Bangladesh Water Development Board
CCP	Chittagong Coastal Plain
CEGIS	Center for Environmental and Geographic Information Services
CEIP	Coastal Embankment Improvement Project
DPM	Design Planning & Management Consultants
ECA	Environmental Conservation Act
ECR	Environmental Conservation Rules
ECRRP	Emergency 2007 Cyclone Recovery and Restoration project
EIA	Environmental Impact Assessment
EMF	Environmental Management Framework
EMP	Environmental Management Plan
ES	Environmental Screening
ESC	Environment, Social and Communication unit
GTPE	Ganges Tidal Plain East
GTPW	Ganges Tidal Plain West
HYV	High Yielding Variety
IEE	Initial Environmental Examination
IESCs	Important Environmental and Social Components
KJDRP	Khulna-Jessore Drainage Rehabilitation Project
LLP	Low Lift Pump
MDP	Meghna Deltaic Plain
MT	Metric Ton
PCD	Project Concept Document
PIC	Project Implementation Consultant
PID	Project Information Document
SEA	Strategic Environmental Assessment
SLR	Sea Level Rise
SWT	Sallow Tube well
TOR	Terms of Reference
UNFCCC	United Nations Framework Convention on Climate Change
UNESCO	United Nations Educational, Scientific and Cultural Organization
WMIP	Water Management Improvement Project

Executive Summary

Introduction

Bangladesh is a hydraulic civilization situated at the confluence of three great trans-Himalayan rivers—the Ganges, the Brahmaputra (or Jamuna), and the Meghna (GBM). The GBM river system marks both the physiography of the nation, as well as the culture and livelihood of the people. While over 90 percent of the GBM catchment lies outside of Bangladesh, approximately 200 rivers and tributaries of the GBM drains through the country via a constantly changing network of estuaries, tidal inlets, and tidal creeks, before emptying out into the Bay of Bengal[1]. Thus, the coastal zone of Bangladesh, the lowest landmass of the country, is continually influenced by these Himalayan drainage ecosystems. Figure 1 shows the coastal area of the country.

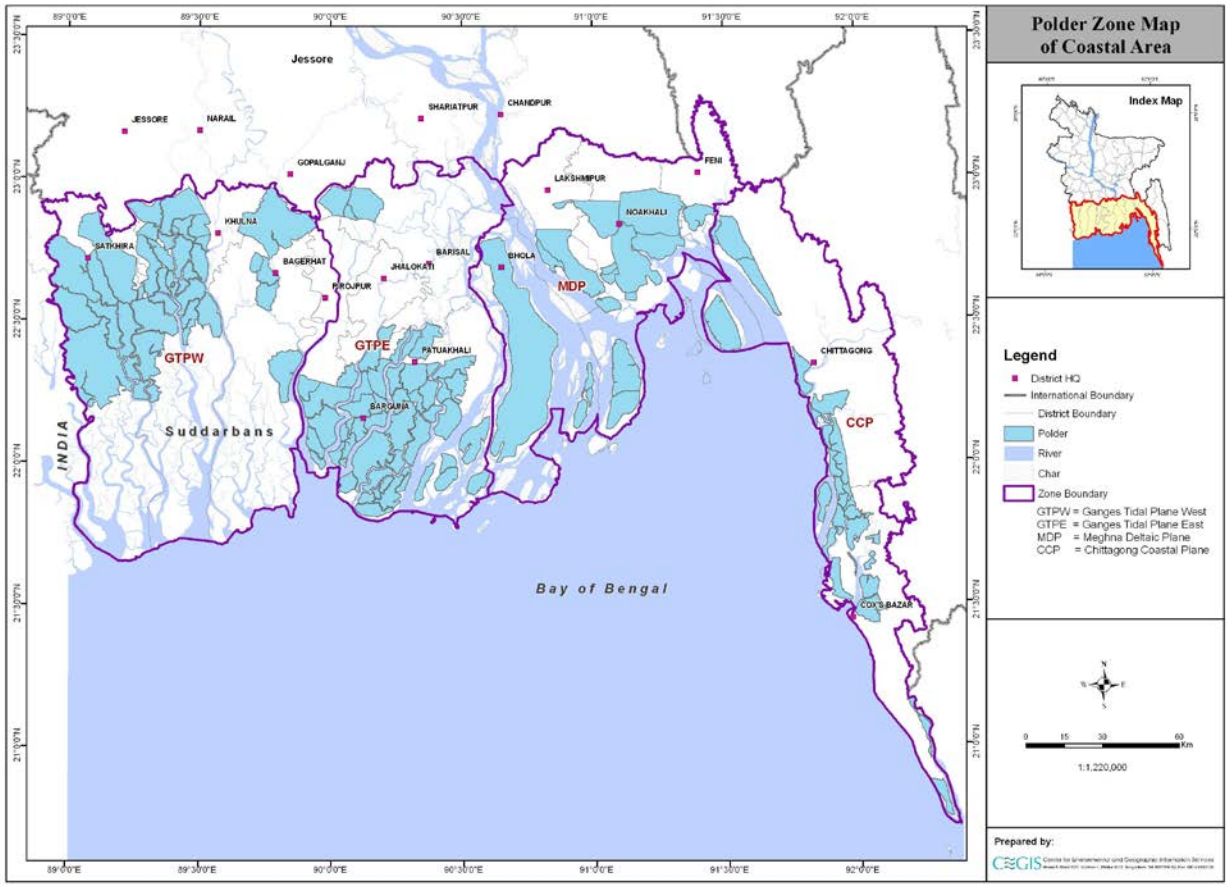


Figure E.1: Coastal Area of the Country

Primarily, the coastal embankment system brought immense benefits to the people living along low lying areas. The system was designed originally to protect against the highest tides, without much attention to storm surges. Recent **cyclones** brought substantial damage to the embankments and further threatened the integrity of the coastal polders. In addition to breaching of the embankment due to cyclones, siltation of peripheral rivers surrounding the embankment caused the coastal polders to suffer from **water logging,** which lead to large scale environmental, social and economical degradation. **Poor maintenance** and

[1] Yu W. et al., 2010. Climate Change Risks and Food Security in Bangladesh. World Bank.

inadequate management of the polders have also contributed to internal drainage congestion and heavy external siltation. As a result, in some areas soil fertility and good agriculture production are declining because of water logging and salinity increase inside polders.

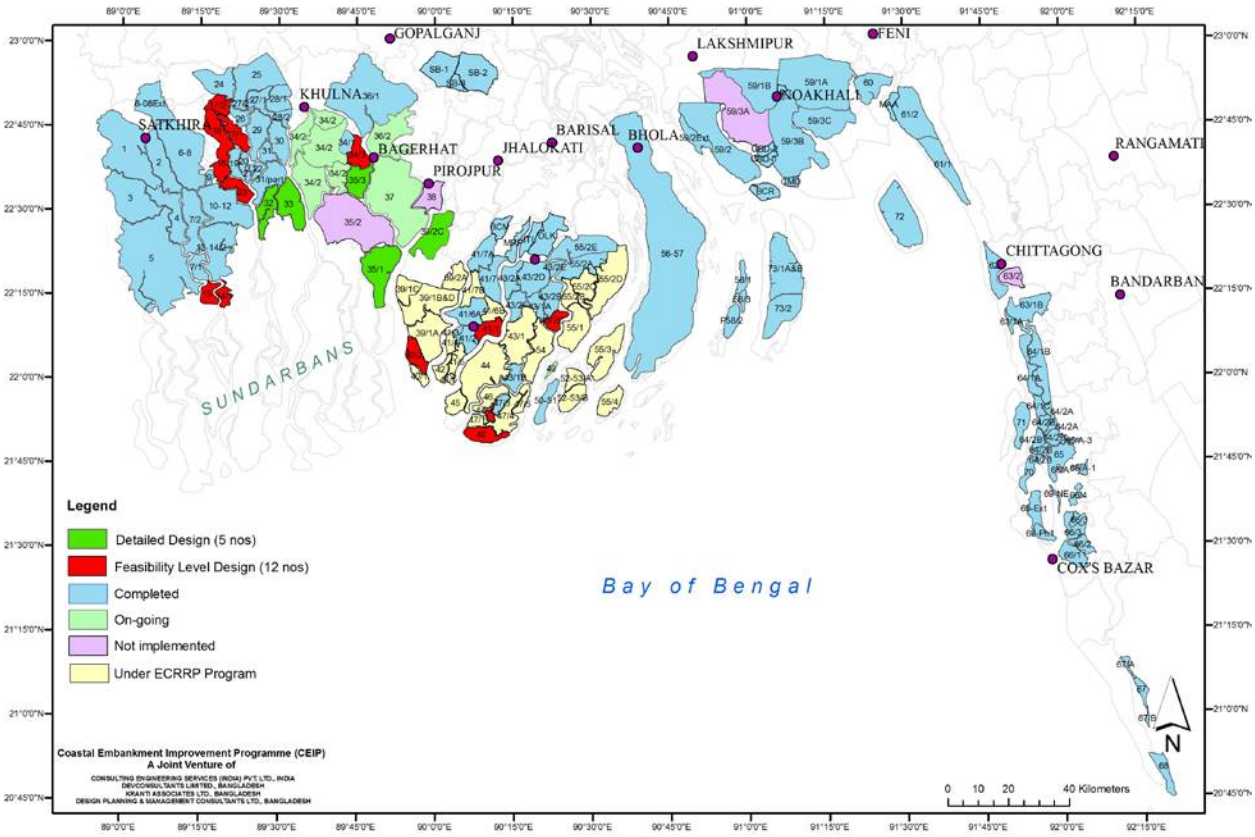


Figure E.2: Coastal Polder Map of Bangladesh

Given that most polders have been built during the 1960's, the entire embankment system needs to be upgraded to protect vulnerable community from tidal inundation, drainage congestion, storm surge and salinity intrusion.

The long term objective is to increase the resilience of the entire coastal population to tidal flooding and natural disasters by upgrading the whole embankment system. With an existing network of embankment of nearly 6,000 km long with 139 polders, the magnitude of such a project is enormous. Hence a multi-phased approached will be adopted over a period of 15 to 20 years. The proposed Coastal Embankment Improvement Project –Phase 1 (or CEIP-I) is the first phase of this long term program. A strategic polder assessment was undertaken and a multi criteria analysis was developed to guide the gradual selection of polders. The key criteria are: physical condition of the embankment and the drainage system, economic activities in the polders (agriculture or fishery), population and socio economic conditions, environmental condition and economic efficiency considerations. Based on this assessment a first priority group of 17 polders was selected. Among the seventeen, 4-5 will be considered for the first package of investment.

Environmental Management Framework (EMF): The proposed interventions of CEIP project will have significant impacts on the natural environment and the people living in that area. Proper environmental assessment and environmental management plan are essential to address the impacts of the project. This Environmental Management Framework (EMF) has been developed to ensure that neither the project

activities (both in terms of needs and quality) nor the environment is compromised through the program intervention.

The EMF presents possible impacts of the CEIP-1, mitigation, enhancement, contingency and compensation measures, environmental management and monitoring plan, and institutional framework including inter-agency cooperation for implementing EMP. The EMF will facilitate compliance with the World Bank's environmental safeguard policies and with the Government of Bangladesh's policies, acts and rules. The EMF will contribute to ensure environmental sustainability by:

- preventing and/or mitigating any negative environmental impact that may emerge from the rehabilitation and improvement of polders;
- enhancing environmental outcomes of the activities by proper implementation of the Environmental Management Plan;
- ensuring the long-term sustainability of benefits from afforestation, and community environment management plan by securing the natural resource base on which they are dependent; and
- facilitating support in establishing an environmental management system (EMS) in the BWDB to enable BWDB to target, achieve and demonstrate continuous improvement in environmental performance of the polder system from preconstruction to operation and maintenance stage.

The implementing agency BWDB prepared The 'Environmental Management Framework (EMF)' by following five major steps (a) Reviewing policies, regulations and administrative frameworks; (b) Reviewing information on the polders and consultation with stakeholders; (c) Developing a Screening Matrix for identifying Important Environmental Component (IEC) and assessing impacts; (d) Developing guidelines for preparing sub-project specific environmental management plan; and (e) Identifying of assessment criteria for strengthening institutional capacity for EMP implementation as well as mechanism for inter-agency co-ordination.

Project Description

The project will comprise the following components.
Component A – Rehabilitation and Improvement of Polders ($291 million).

Component A1: Rehabilitation and Improvement of Polder ($286 million). This component will finance activities that aim to increase community resilience to tidal flooding and storm surges. Investments include: (i) rehabilitation of critical portions of polder embankments including slope protection work, (ii) increasing embankment height in some stretches to improve resilience, (iii) repairing and upgrading drainage and flushing systems within polders, and (v) improving operations and maintenance (O&M). The reconstruction and rehabilitation works will be designed with improved standards so that protection is for both tidal flooding and frequent storm surges. It is expected that about 17 polders will be rehabilitated under this component. The final polder selection will depend on technical, environmental and social conditions.

Stakeholders and beneficiaries consultations and participation would be central to carrying out the improvement works to the polder system. The beneficiaries, through their formal and informal water management organizations (WMOs), will be involved in all stages of project implementation from identification of works, prioritization, design, and construction. Consultations will be carried out by the consultants and NGOs with support from the BWDB under component B1.

Improving the embankment system will provide stronger protection to people living inside polders from storm surges; hence reducing the recovery time after a natural disaster such as a cyclone. Improving the

internal drainage system will enhance agriculture production, which is the primary source of livelihood for coastal population. Protecting assets and enhancing agricultural production will bring in much needed economic growth to the coastal population.

Component A2: Afforestation ($5 million). Afforestation is critical to the security of embankment. Planting of selected mangrove and other salt tolerant species are planned as a protective belt on the tidal inundation zone on the riverside of the embankment. Planting of a range of commercial wood, fruit and other tree species in phase with livelihoods needs of landless, marginalized and poor villagers are proposed on the inside of embankments. Plantings would commence after clarification of land-use and land ownership issues and the completion of earthworks in restored embankments. The afforestation component will engage community participation in pro-poor approaches to encourage ownership and benefit sharing in an attempt to achieve social, environmental and economic sustainability. The component will finance efforts to build capacity of local government institutions, Water Management Organization, NGOs and community organizations in secondary maintenance schemes for improved O&M, foreshore and embankment afforestation and protection of embankment toe against erosion.

Component B–Implementation of Social Action and Environment Management Plans (US$56 million).

Component B1: Implementation of Social Action Plan (US$3 million). This component will support consultation with and strengthening of polders' stakeholders and beneficiaries as well as formal and informal water management organization (like water management groups, water management associations and embankment management groups). Under this component, intensive social mobilization will be piloted in 6 polders to establish participatory WMOs that will be responsible for the operation and minor maintenance works of the polders. The establishment of WMOs will follow an eight step process, as identified in the *Guidelines for Integrated Planning for Sustainable Water Resources Management*, published by BWDB in 2008. Social mobilization is expected to last around two years, during which time the WMOs will be established and trained in participatory planning, as well as in operation and minor maintenance activities. It is expected that the detailed design of the polders identified under the pilot scheme will engage in a participatory planning exercise with BWDB in the identification of civil works, and that construction activities will be supported by local community members, where possible. Finally, small works, including minor periodic maintenance and operation of minor hydraulic infrastructure would be undertaken by the WMOs under a memorandum of understanding with BWDB. In the remaining polders, Polder Committee(s) will be established to determine the competing needs and uses for water resources, and to decide on the operation of hydraulic infrastructure. Should the participatory approach prove to be successful, it would be scaled up under the next phase of investments. Technical assistance will be provided to local NGOs executing the social mobilization for this sub component. It will also support the implementation of social action plan identified during the consultative, design and implementation phases.

Component B2: Implementation of Resettlement Action Plans (US$49 million). Polder scheme rehabilitation is a complex project that involves a variety of issues ranging from land acquisition, physical and economic displacement of people and other unanticipated impacts. Generally there are squatters on the embankments as they are safe structures. A Social Management and Resettlement Policy Framework (SMRPF) has been prepared and will be disclosed in accordance with Bank guidelines. This component will finance the implementation of the Resettlement Action Plans (RAP), embankment monitoring and public consultation plans. The component will finance the resettlement and rehabilitation of persons adversely affected by the project. It will also support the development of a system to computerize land acquisition and resettlement data with Global Position System (GPS) reference and independent institute to undertake surveys and verify field data in order to guard against improper targeting of beneficiaries and/or false delivery of benefits in case of SAP/RAP.

Component B3. Implementation of Environment Management Plan (US$4 million). An overall environmental assessment of the polder system; an Environmental Management Framework (EMF) for the project; and Environment Impact Assessment (EIA) for polders targeted under the first package of investment have already been prepared. This component will finance: (i) the preparation of EIAs for all remaining polders; (ii) the implementation of the Environment Management Plan (EMP) and environmental mitigation and enhancement measures; and (iii) the establishment of an environmental monitoring system in BWDB to enable it to track continuous improvement in environmental performance of the polder system. Some of the items under EMP will be integrated with the civil works and included in the budget of Component A1.

Component C- Construction Supervision, Monitoring & Evaluation of Project Impact, Supervision of Social and Environment Plans, and Delta Monitoring (US$32 million)

Component C1: Detailed Design and Construction Supervision (US$16 million). This component will cover consulting services for (i) surveys, designs of remaining polders to be included in the project (other than the 5 for which detailed designs have already been completed), and (ii) construction supervision of rehabilitation and improvement of coastal embankments. This will include facilitating consultations with local communities in identifying needs and suitable design of the embankment as well as with other stakeholders such as local government, *upazilla* and union level governments. The component will finance surveys required prior to construction work.

Component C2: Monitoring and Evaluation of Project Impact and Supervision of EMP, SAP/RAP (US$4 million). This component will cover consulting services for continuously monitoring project activities and providing feedback to the government and the implementing agency on the project's performance. This includes supervising the implementation of the EMP, SAP and RAP. In addition, it will provide third party assessment and monitoring of key aspects of project implementation. The project will also look into the feasibility of undertaking an impact evaluation.

Component C3: Long Term Monitoring, Research and Analysis of Bangladesh Delta and Coastal Zone (US$12 million). The Bangladesh Delta and its coastal zone is a crucial region for Bangladesh, and it is subject to a multitude of complex natural phenomena that are not fully understood as of now. The region is experiencing fast paced changes due to changes in river morphology, fluvial processes, human intervention, and climate change. To tackle this knowledge gap and enhance people's understanding of this complex environment, the project will support a comprehensive monitoring and morphological assessment of the Bangladesh Delta. A program to extend the current monitoring systems in Coastal Bangladesh is also essential to generate data, information, and new knowledge for assessments of effects of multiple drivers on the environment of coastal zone and guide future design, rehabilitation and improvement requirements. The monitoring will cover sediment rates and composition; erosion rates; sea level rise; subsidence rates; tidal dynamics changes; river cross section changes and meander migration; shoreline changes; and any relevant geomorphological attributes.

This work will be carried out by key institutions in Bangladesh, such as IWM, CEGIS, Dhaka University, BUET, and BWDB, in cooperation and twining arrangements with international institutions and experts in the topic of estuarine and coastal morphology and geomorphology. This twining arrangement is needed to build in-house capacity and guide local institutions and experts to improve their understanding of the physical processes of such a complex delta system. The project will support the installation and operation of needed equipment and systems on the ground, technical expertise, provision of advanced technology and equipment, high resolution specialized remote sensing images, and the capability to analyze these images. The project will support procurement of goods, services, and incremental operation costs in carrying out this research and analysis, and the development of databases and information systems that will be made available widely both within and outside of Bangladesh.

Component D – Project Management, Technical Assistance, Training and Strategic Studies (US$21 million).

This component will support BWDB in implementing the project through the establishment of a fully functioning Project Management Unit (PMU). It will provide resources for needed strategic studies (including the continuous updating of the strategic polder assessment as well as all necessary preparatory studies for following phases of the CEIP), institutional capacity building, technical assistance and training.

Component E – Contingent Emergency Response Component ($0 million)

In case of a major natural disaster, the Government may request the Bank to re-allocate project funds to this component (which presently carries a zero allocation) to support response and reconstruction[2]. This component would allow the Government to request the Bank to cancel project funds from Immediate Response Mechanism (IRM) portfolio projects and designate them as IRM funds to be engaged to partially cover emergency response and recovery costs. This component could also be used to channel additional funds should they become available as a result of the emergency.

Policies, Legal and Administrative Framework

A wide range of laws and regulations like Environment Conservation Act, 1995 (ECA, 1995), and the Environment Conservation Rules (ECR, 1997) related to environmental issues relevant to this project have been reviewed. Under the Environmental Conservation Rules (1997) a classification system was established for development projects and industries on basis of the project objective. These categories are: Green, Orange A, Orange B, and Red. The construction/reconstruction/expansion of flood control embankment, polder etc is categorized as **Red** in accordance DOE's classification. For 'Red' category, it is mandatory to carry out Environmental Impact Assessment (EIA) including Environmental Management Plan (EMP) and where necessary develop a Resettlement Plan for getting environmental clearance from DoE. According to the World Bank requirement, the project has been classified as "**Category A**" considering the risk associated with widely involved major civil works by reconstruction and rehabilitation of the coastal embankment to protect against tidal flooding and storm surges. Since the coastal area is populated and used for cultivation widelycertain negative environmental impacts may occur during the implementation and operational phase on overall polder system.

Baseline Information

The coastal area covers different types of land uses ranging from agriculture/fallow lands (63%), settlements (19%), and remaining water bodies/rivers to forest. The GTPW (Ganges Tidal Plain West) and CCP (Chittagong Coastal Plain) zones are mostly covered by mangroves and other forests. Inside the polder areas about 64% and 30% of the total area of 139 polders is being as agriculture/fallow lands and settlements respectively.

The coastal areas comprises three climatic such as South-eastern, South-western, South-central zone out of seven climatic zones of Bangladesh. In the coastal zone of Bangladesh, maximum and minimum temperatures range from 30^0C to 36^0C and 11^0C to23^0C respectively. Annual rainfall ranges from a little over 1,700 mm in the west to over 3,200 mm at Cox's Bazar in the east.

Coastal areas are endowed with both fresh and brackish water resources. Brackish waters are mainly in the estuarine part of the rivers and tidal cannels/ creeks. Major rivers flowing though the coastal area are Gorai – Madhumati -Baleswar River and Rupsha - Pussur River in the GTPW zone; Buriswar River in

[2] Such a reallocation would not constitute a formal Project Restructuring.

GTPE (Ganges Tidal Plain East) zone; Meghna River in MDP (Meghna Deltaic Plain) zone; and Karnafuli River and Feni River in CPP zone.

The air quality is not of much significant concern in the coastal area of Bangladesh. The present air quality is within the standard limits in most areas. In case of water quality both surface and ground water parameters are found within drinking water quality except chloride content.

Most of the soils of the coastal area are saline and non-calcareous, except for some soils of the Old Ganges and Meghna floodplain area. The coastal area covers about 3.6 million acres of net cultivated area (NCA) with average cropping intensity of 175% where mostly local and HYB rice crops area grown. Soil salinity is the most dominant limiting factors for agricultural practices in this region especially during the dry season.

The ecosystems mainly includes marine, brackish water, freshwater, mangrove, Sundarbans, floodplain, island, peninsula, and terrestrial ecosystem (roadside and homestead). Moreover, shrimp farming pond (Gher) ecosystem is found in this area. The world largest mangrove forest- the Sundarbans are located in this area. The mangrove forests are not only the transional zones between fresh and marine water ecosystems but also serve as a natural fence against cyclonic storm and tidal surges. The major natural hazards and disaster are cyclonic storm, river floods, water logging, salinity (both soil and water), river erosion.

Many parts of the coastal area of Bangladesh is facing water logging problem, especially in southwestern region (Khulna, Satkhira, Jessore districts) and Noakhali region. Water logging is created due to natural process of sedimentation in the river and drainage channels as well as improper maintenance of regulators and drainage channels in the coastal polders. About 30% of all polders are now experiencing water logging in the coastal area.

Saline water intrusion in coastal area is highly seasonal in Bangladesh. Salinity and its seasonal variation are dominant factor for coastal ecosystem, fisheries and agriculture. Freshwater flow decreases in the Pasur-Sibsa river system during dry season, the saline front moves upward by 30-40 km. In the Baleswar-Bishkhali river systems, in the dry season 5ppt saline front moves landward by 20-25km from the coastline. In the middle part of coastal zone along the Meghna estuary, landward salinity intrusion is low because of huge freshwater flow coming through the Meghna river system.

The economic activities of farmers usually are concentrated to land and water resource based activities such as agriculture, fisheries, salt farming, etc. The economic activities of wage labors are more diversified than other groups, although most of them are engaged in agriculture works. Women are usually engaged in household based works like homestead gardening, poultry and livestock farming, cottage industry, small business, fish fry collection, etc.

Alternative Analysis

The alternative analysis for CEIP project will be conducted for two scenarios . (a) Scenario1 will analyze the "no action" alternative of the project which will be reflected in this document and during embankment specific environmental assessment. It has been found the project will bring reduction of drainage congestion, reduction of tidal flood/storm surge, increasing flood free land type, increasing cropping intensity, increase of cropped area and crop production, increase of fish pond and production and increasing employment opportunity.

Scenario 2 will conduct embankment specific alternative analysis for the project design, technical options, and implementation method in terms of environmental impact. The second scenarioanalysis will be conducted separately for each of the embankment and will be reflected in the Environmental Impact

Assessment and Initial Environmental Examination report. The parameters to be considered for alternative analysis are but not limited to construction method, sources of material, disposal of sludge material, protection measures for reducing bank erosion, location and type of plantation and mode of transportation.

Environmental Impacts

Anticipated environmental impacts of the Project, are broadly classified into three categories: preconstruction, construction, and operation.

Preconstruction: The anticipated impacts are loss of agricultural land, encroachment of fish habitat, loss of biomass, siltation due to loose soil, air and noise pollution, change in landscape and displacement of people.

Construction: The anticipated impacts are air pollution, noise pollution, degradation of land scape, collection of soil material for earthen work from surrounding areas may create destruction of nearby structures, erosion from collection site., borrow pit may induce nuisance plant growth which will effect agriculture production, increased siltation in the water bodies. During dredging substrate removal will inevitably affect spawning, suspended sediment in the water affects the respiratory system of fish, growth may also be affected since food supply and feeding success are reduced in the turbid conditions, location of labor camp will create odor, solid waste management. Sources of material and disposal of dredged material are the main concern.

Operation: Water logging, Soil erosion and sedimentation mismanagement, eutrophication in the borrow pit, Hydraulic Structures will create barrier for fish migration, Improper selection of plant will introduce nuisance plant, mosquito breeding in the ponding of borrow pit, removal of polypropelene bag etc are the issues during operation phase.

Enhancement: The project will have a positive impact in preventing a substantial part of the people in the project area from becoming landless. All strata of the population will benefit from the protecting agricultural land, homesteads, markets, hospitals schools roads, irrigation systems etc. Increased agricultural production and the construction works of the project will generate more employment opportunities for the poor and landless. To maximize the benefit the contractor is required to recruit local laborers.

Environmental Management System

Based on an extensive literature review and expert consultation, a screening matrix has been developed for sub-projects under CEIP for collecting information through site visit, interview/ consultation with stakeholders, focus group discussion in the project site. Process of IEE study and preparation of TOR for EIA study is outlined briefly for IEE and EIA study of each sub-project. Also guidance for carrying out the detail environmental assessment studies (IEE and EIA) for specific sub-projects and implementing EMP as outlined in the framework. The format of environmental screening, IEE and EIA studies along with reporting structures are presented in this report. Moreover, process of preparing EMP and required institutional arrangement and capacity building are also presented.

A comprehensive EMP which focuses on managing construction phase-related impacts should suffice in managing the potential construction and operation phase impacts. The EMP will be attached with the Bidding Document. The environmental management parameter will be included in the BoQ. Since many contractors do not have clear understanding the need of environmental management, some tend to quote

very low price for implementation of EMP and eventually cannot implement EMP as per design. To avoid this problem, Fixed Budget will be assigned for EMP implementation. The contractors may need orientation on the requirement of the EMP in the pre-bidding meeting. The contractor needs to submit an Environmental Action Plan (EAP) based on the EIA and EMF in line with the construction schedule and guideline. The EAP needs to be reviewed by the supervision consultant and cleared by BWDB and World Bank.

Extensive monitoring of the environmental concerns of the CEIP project will be required as per World Bank guideline. The monitoring program will help to evaluate: (i) the extent and severity of the environmental impacts against the predicted impacts and baseline; (ii) the performance of the environmental protection measures or compliance with pertinent rules and regulations; (iii) trends in impacts; and (iv) overall effectiveness of the project environmental protection measures. The monitoring plans should be included in the EMP for specific sub-projects. Moreover, for all type of monitoring, a comprehensive **database of the polder specific Environmental Impact and Monitoring information** should be created, which will help to evaluate the impacts easily.

Institutional Responsibility and Report Requirement

The **contractor** is responsible for implementation of EMP during construction works and Project Supervision Consultant is primarily responsible for supervision of the implementation of the EMP. BWDB will conduct field inspections and surveys by the environment specialist (to be employed by BWDB on regular basis) at field. S/he will report to the Senior Environment Specialist at Head Quarter. The M&E consultant will be responsible for independent monitoring and implementation of EMP, and external monitoring and evaluation. DoE will be consulted if complicated issues arise during construction and operation stages. BWDB will apply for annual site clearance from DoE. WMOs will be trained to ensure environmental management during project operation. Environmental Management Unit of BWDB, strengthened through this project, will ensure and oversee the environmental management during project operation.

BWDB will prepare the **Half Yearly Progress Report** on environmental management and will share with World Bank for review. Contributing development partners (if any) may join the field visit to understand the environmental compliance of the project. In addition, the effectiveness of screening, monitoring and implementation of EMP will be carried out by the third party monitoring firm along with the project component activity monitoring annually. The **Annual Environmental Audit Report** prepared by the third party monitoring firm will be shared with the safeguards secretariat.

The Environment, Social and Communication Unit (ESC) to be established to implement and manage the EMP will be structured to provide co-ordination, technical support and services during the environmental screening and preparation of EA, and implementation of the environmental mitigation measures. At least one of the two environmental specialists must be on board before effectiveness of the project. The specialists will prepare subproject specific environment screening/assessment report with EMP, supervise the implementation of EMP and support capacity building of the field level staff of BWDB and contractor. ESC will review the EMF and ensure quality of the environmental screening/assessment with EMP.

Public Consultation & Disclosure Requirement

For all Category A (e.g. CEIP project) projects the borrower should consult the project-affected groups and local nongovernmental organizations (NGOs) about the project's environmental aspects and takes their views into account. The borrower should initiate such consultations as early as possible. For Category A projects, the borrower should consult these groups at least twice: (a) shortly after environmental screening and before the terms of reference for the EMF or EA are finalized; and (b) once a draft EMF or EA report is prepared. In addition, the borrower should consult with such groups throughout project implementation as necessary to address EA-related issues that affect them. During EMF preparation **four consultation workshops have been carried** out. Although this EMF will be the guiding framework for taking care of environmental concerns of the CEIP, and has been consulted before preparing, it may be required to update this in future to comply with policy, legal or institutional changes.

Workshop: Workshops would be organized at the local and national level to disclose the findings of the environmental assessment study of CEIP project (e.g. proposed project's objectives, description, potential impacts and summary of EA). Representative of implementing authority, the study team, and the government officials from different departments, representatives from LGIs, and representatives from NGOs, local communities of different occupation, journalist, and local elite/civil society may attend the workshops. In the workshops, the participants will share their observations, views, and remarks with the study team. Appropriate suggestions and recommendations on different issues from the stakeholders of the meeting would be incorporated in the environmental assessment study especially the EIA/SIA. The workshops will also help to resolve conflicting issues among stakeholders.

Publication in electronic and print media: The summary information on project interventions and the findings of environmental assessment would also be disclosed through newspapers and electronic media (e.g. internet, TV, radio, etc.). Summary of the document will be disclosed in Bengali language.

Availability of the Document*:* The Environmental Assessment, documenting the mitigation measures and consultation process, will be made available for public review in both English and Bengali. The summary EA will be published on the BWDB and WB websites, and the full environmental report will be available upon request from the WB and will be accessible in BWDB website. Hard copy of the EA and EMF will be available at CEIP Divisional office.

Chapter 1 : Introduction

1.1 Project Background

1. Bangladesh is a hydraulic civilization situated at the confluence of three great trans-Himalayan rivers—the Ganges, the Brahmaputra (or Jamuna), and the Meghna (GBM). The GBM river system marks both the physiography of the nation, as well as the culture and livelihood of the people. While over 90 percent of the GBM catchment lies outside of Bangladesh, approximately 200 rivers and tributaries of the GBM drains through the country via a constantly changing network of estuaries, tidal inlets, and tidal creeks, before emptying out into the Bay of Bengal[3]. Thus, the coastal zone of Bangladesh, the lowest landmass of the country, is continually influenced by these Himalayan drainage ecosystems.

2. The coastal zone[4] spans over 580 km of coastline and is prone to multiple threats. Sixty-two percent of the coastal land has an elevation of up to three meters and eighty-three percent up to five meters above mean sea level[5]. The zone constitutes 32 percent of the land area and hosts nearly 28 percent of the population[6] (i.e., nearly 42 million[7]).

3. Primarily, the coastal embankment system brought immense benefits to the people living along low lying areas. The construction of polders along the entire coastal belt provided protection to the people and their agricultural land. Today thanks to the polder system over 1.2 million hectars of land is under agriculture within the embankment system. However most of the system, constructed back in the 60's was designed originally to protect against the highest tides, without much attention to storm surges. Recent **cyclones** brought substantial damage to the embankments and further threatened the integrity of the coastal polders. In addition to breaching of the embankment due to cyclones, siltation of peripheral rivers surrounding the embankment caused the coastal polders to suffer from **water logging,** which lead to large scale environmental, social and economical degradation. **Poor maintenance** and inadequate management of the polders have also contributed to internal drainage congestion and heavy external siltation. As a result, in some areas soil fertility and good agriculture production are declining because of water logging and salinity increase inside polders.

4. All the above reasons have led the Government to **re-focus its strategy** on the coastal area from one that only protects against high tides to one that provide protection against frequent storm surges. The Government has recognized the need for a **systematic approach** to upgrade the coastal embankment system to protect against an appropriate return period and be based on sound local risk and vulnerability assessment. Moreover, the embankment program needs to be accompanied with afforestation program particularly on the sea side, as forestation has been shown to significantly reduce storm surge damages.

5. The rehabilitation and upgrading of coastal embankment is a prime objective of the *Bangladesh Climate Change Strategy and Action Plan* (BCCSAP) strategy. Bangladesh is one of 9 countries selected to participate in the *Pilot Program for Climate Resilience* (PPCR) established under the multi donor Climate Investment Fund (CIF). As part its *Strategy Program for Climate Resilience* (SPCR) Bangladesh submitted a request for a $25 million grant to increase the resilience of coastal infrastructure through the proposed CEIP project. This request was approved by the PPCR steering committee in November 2010. The Ministry of Environment and Forests is the focal ministry for all work on climate change, including international negotiations.

6. The project will be implemented by BWDB which is the principal water institution in Bangladesh. BWDB is an autonomous agency under Ministry of Water Resources (MWR). BWDB has the sole mandate for the construction, rehabilitation, and operation and maintenance of embankments in Bangladesh.

[3] Yu W. et al., 2010. Climate Change Risks and Food Security in Bangladesh. World Bank.
[4] The delineation of the Coastal Zone, approved by the Ministry of Water Resources in 2003, comprises 19 districts, 147 upazillas and the exclusive economic zone.
[5] Bangladesh Water Development Board, 2011. Coastal Embankment Improvement Project, Draft Midterm Report.
[6] Islam, M.R., 2004. Where land meets the sea: a profile of the coastal zone of Bangladesh. Dhaka, the University Press Limited. 317 pp.
[7] Bangladesh population 148.7 million in 2010 per World Bank Open Data.

1.2 Rationale of the Environmental Management Framework (EMF)

7. The proposed interventions of CEIP project will have significant impacts on the natural environment and the people living in that area. Proper environmental assessment and environmental management plan is essential to address the impacts of the project. This EMF has been developed to ensure that neither the project activities (both in terms of needs and quality) nor the environment is compromised through the program intervention.

8. The EMF presents possible impacts of the CEIP-1, mitigation, enhancement, contingency and compensation measures, environmental management and monitoring plan, and institutional framework including inter-agency cooperation for implementing EMP. The EMF will facilitate compliance with the World Bank's environmental safeguard policies and with the Government of Bangladesh's policies, acts and rules . The EMF will contribute to ensure environmental sustainability by:

- preventing and/or mitigating any negative environmental impact that may emerge from the rehabilitation and improvement of polders;
- enhancing environmental outcomes of the activities by proper implementation of the Environmental Management Plan;
- ensuring the long-term sustainability of benefits from afforestation, and community environment management plan by securing the natural resource base on which they are dependent; and
- facilitating support in establishing an environmental management system (EMS) in BWDB)to enable it to target, achieve and demonstrate continuous improvement in environmental performance of the polder system from preconstruction to operation and maintenance stage.

1.3 Approach and Methodology for Developing the EMF

9. The implementing agency BWDB prepared The 'Environmental Management Framework (EMF)' by following five major steps (a) Reviewing policies, regulations and administrative frameworks; (b) Reviewing information on the polders and consultation with stakeholders; (c) Developing a Screening Matrix for identifying Important Environmental Component (IEC) and assessing impacts; (d) Developing guidelines for preparing sub-project specific environmental management plan; and (e) Identifying assessment criteria for strengthening institutional capacity for EMP implementation as well as mechanism for inter-agency co-ordination. The methodology for the preparation of the EMF is presented in Figure 1.1.

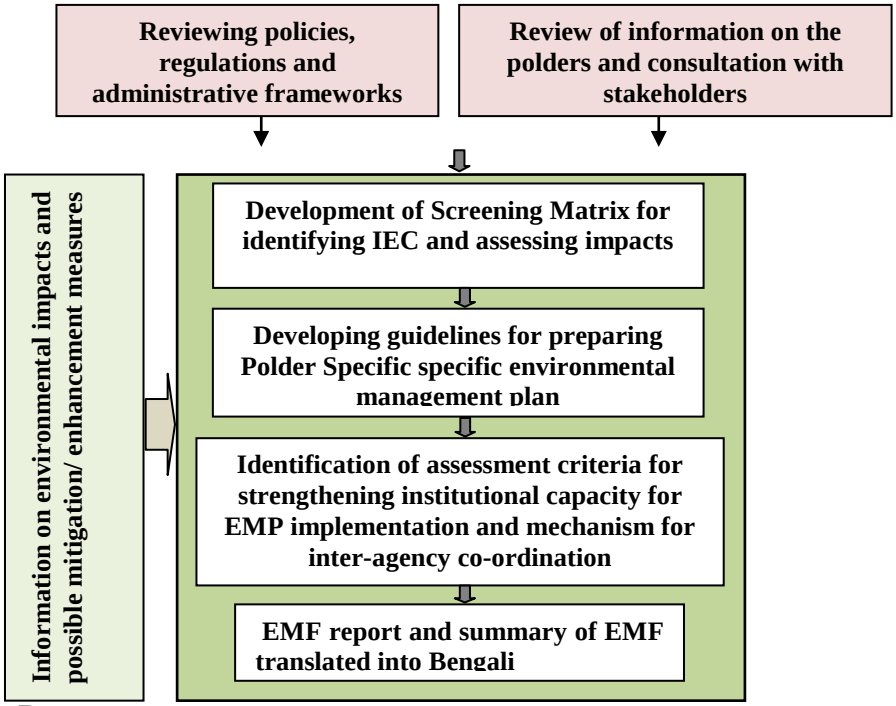


Figure 1-1: Methodology of EMF

1.4 Structure of the Report

The report on Strategic Environmental Assessment of CEIP-1 Project has a total of 11 chapters as outlined below.

Chapter 1: Introduction: This chapter describes the background of the project, rationale of the EMF and methodology to prepare the EMF.

Chapter 2: Description of the Proposed Project: This chapter includes brief description of the proposed interventions under CEIP project.

Chapter 4: Environmental Policies, Legal and Administrative Framework: This chapter contains the brief of the relevant national and international policies, regulations and administrative procedures relevant for the CEIP project.

Chapter 5: Environmental and Social Baseline: This chapter presents the existing environmental and social baseline of the coastal areas.

Chapter 6: Analysis of Alternatives: This chapter presents the analysis of alternative. The chapter presents the impact with and without project and also sets up a guideline to conduct alternative analysis

Chapter 7: Possible Environmental Issues with Mitigation Measures & Benefit of the Project: The possible impacts of CEIP project interventions on the environmental and social components have been outlined in this chapter. It also outlined the possible environmental impact and associated mitigation measures.

Chapter 8: Environmental Management System: This chapter presents the Methodology of environmental screening and conducting Initial Environmental Examination (IEE) and process of conducting Environmental Impact Assessment (EIA) and preparing environmental management plans to mitigate negative impacts, enhance positive impacts for specific sub-projects under CEIP project.

Chapter 9: Institutional Arrangement and Capacity Building: This chapter identified the gaps in institutional capacity of the BWDB and required institutional arrangements for implementing EMP.

Chapter 9: Public Consultation and Disclosure: This chapter presents the findings of public consultation and the process of public disclosure of the environmental assessment reports of the CEIP project.

Chapter 2 : Description of the Proposed Project

2.1 Proposed CEIP project

10. BWDB's long term objective is to increase the resilience of the entire coastal population to tidal flooding and natural disasters by upgrading the whole embankment system. With an existing network of embankment of nearly 6,000 km long with 139 polders, the magnitude of such a project is enormous. Hence a multi-phased approached will be adopted over a period of 15 to 20 years. The proposed Coastal Embankment Improvement Project –Phase 1 (or CEIP-I) is the first phase of this long term program. A strategic polder assessment was undertaken and a multi criteria analysis was developed to guide the gradual selection of polders. The key criteria are: physical condition of the embankment and the drainage system, economic activities in the polders (agriculture or fishery), population and socio economic conditions, environmental condition and economic efficiency considerations. Based on this assessment a first priority group of 17 polders was selected. Among the seventeen, 4-5 will be considered for the first package of investment..

2.2 Description of Project Component

11. The project will comprise the following components:

Component A – Rehabilitation and Improvement of Polders ($291 million).

12. **Component A1: Rehabilitation and Improvement of Polder ($286 million).** This component will finance activities that aim to increase community resilience to tidal flooding and storm surges. Investments include: (i) rehabilitation of critical portions of polder embankments including slope protection work, (ii) increasing embankment height in some stretches to improve resilience, (iii) repairing and upgrading drainage and flushing systems within polders, and (v) improving operations and maintenance (O&M). The reconstruction and rehabilitation works will be designed with improved standards so that protection is for both tidal flooding and frequent storm surges. It is expected that about 17 polders will be rehabilitated under this component. The final polder selection will depend on technical, environmental and social conditions.

13. Stakeholders and beneficiaries consultations and participation would be central to carrying out the improvement works to the polder system. The beneficiaries, through their formal and informal water management organizations (WMOs), will be involved in all stages of project implementation from identification of works, prioritization, design, and construction. Consultations will be carried out by the consultants and NGOs with support from the BWDB under component B1.

14. Improving the embankment system will provide stronger protection to people living inside polders from storm surges; hence reducing the recovery time after a natural disaster such as a cyclone. Improving the internal drainage system will enhance agriculture production, which is the primary source of livelihood for coastal population. Protecting assets and enhancing agricultural production will bring in much needed economic growth to the coastal population.

15. **Component A2: Afforestation ($5 million).** Afforestation is critical to the security of embankment. Planting of selected mangrove and other salt tolerant species are planned as a protective belt on the tidal inundation zone on the riverside of the embankment. Planting of a range of commercial wood, fruit and other tree species in phase with livelihoods needs of landless, marginalized and poor villagers are proposed on the inside of embankments. Plantings would commence after clarification of land-use and land ownership issues and the completion of earthworks in restored embankments. The afforestation component will engage community participation in pro-poor approaches to encourage ownership and benefit sharing in an attempt to achieve social, environmental and economic sustainability. The component will finance efforts to build capacity of local government institutions, Water Management Organization, NGOs and community organizations in secondary maintenance schemes for improved O&M, foreshore and embankment afforestation and protection of embankment toe against erosion.

Component B–Implementation of Social Action and Environment Management Plans (US$56 million).

16. **Component B1: Implementation of Social Action Plan (US$3 million).** This component will support consultation with and strengthening of polders' stakeholders and beneficiaries as well as formal and informal water management organization (like water management groups, water management associations and embankment management groups). Under this component, intensive social mobilization will be piloted in 6 polders to establish participatory WMOs that will be responsible for the operation and minor maintenance works of the polders. The establishment of WMOs will follow an eight step process, as identified in the *Guidelines for Integrated Planning for Sustainable Water Resources Management,* published by BWDB in 2008. Social mobilization is expected to last around two years, during which time the WMOs will be established and trained in participatory planning, as well as in operation and minor maintenance activities. It is expected that the detailed design of the polders identified under the pilot scheme will engage in a participatory planning exercise with BWDB in the identification of civil works, and that construction activities will be supported by local community members, where possible. Finally, small works, including minor periodic maintenance and operation of minor hydraulic infrastructure would be undertaken by the WMOs under a memorandum of understanding with BWDB. In the remaining polders, Polder Committee(s) will be established to determine the competing needs and uses for water resources, and to decide on the operation of hydraulic infrastructure. Should the participatory approach prove to be successful, it would be scaled up under the next phase of investments. Technical assistance will be provided to local NGOs executing the social mobilization for this sub component. It will also support the implementation of social action plan identified during the consultative, design and implementation phases.

17. **Component B2: Implementation of Resettlement Action Plans (US$49 million).** Polder scheme rehabilitation is a complex project that involves a variety of issues ranging from land acquisition, physical and economic displacement of people and other unanticipated impacts. Generally there are squatters on the embankments as they are safe structures. A Social Management and Resettlement Policy Framework (SMRPF) has been prepared and will be disclosed in accordance with Bank guidelines. This component will finance the implementation of the Resettlement Action Plans (RAP), embankment monitoring and public consultation plans. The component will finance the resettlement and rehabilitation of persons adversely affected by the project. It will also support the development of a system to computerize land acquisition and resettlement data with Global Position System (GPS) reference and independent institute to undertake surveys and verify field data in order to guard against improper targeting of beneficiaries and/or false delivery of benefits in case of SAP/RAP.

18. **Component B3. Implementation of Environment Management Plan (US$4 million).** An overall environmental assessment of the polder system; an Environmental Management Framework (EMF) for the project; and Environment Impact Assessment (EIA) for polders targeted under the first package of investment have already been prepared. This component will finance: (i) the preparation of EIAs for all remaining polders; (ii) the implementation of the Environment Management Plan (EMP) and environmental mitigation and enhancement measures; and (iii) the establishment of an environmental monitoring system in BWDB to enable it to track continuous improvement in environmental performance of the polder system. Some of the items under EMP will be integrated with the civil works and included in the budget of Component A1.

Component C- Construction Supervision, Monitoring & Evaluation of Project Impact, Supervision of Social and Environment Plans, and Delta Monitoring (US$32 million)

19. **Component C1: Detailed Design and Construction Supervision (US$16 million).** This component will cover consulting services for (i) surveys, designs of remaining polders to be included in the project (other than the 5 for which detailed designs have already been completed), and (ii) construction supervision of rehabilitation and improvement of coastal embankments. This will include facilitating consultations with local communities in identifying needs and suitable design of the embankment as well as with other stakeholders such as local government, *upazilla* and union level governments. The component will finance surveys required prior to construction work.

20. **Component C2: Monitoring and Evaluation of Project Impact and Supervision of EMP, SAP/RAP (US$4 million).** This component will cover consulting services for continuously monitoring project activities and providing feedback to the government and the implementing agency on the project's

performance. This includes supervising the implementation of the EMP, SAP and RAP. In addition, it will provide third party assessment and monitoring of key aspects of project implementation. The project will also look into the feasibility of undertaking an impact evaluation.

21. **Component C3: Long Term Monitoring, Research and Analysis of Bangladesh Delta and Coastal Zone (US$12 million).** The Bangladesh Delta and its coastal zone is a crucial region for Bangladesh, and it is subject to a multitude of complex natural phenomena that are not fully understood as of now. The region is experiencing fast paced changes due to changes in river morphology, fluvial processes, human intervention, and climate change. To tackle this knowledge gap and enhance people's understanding of this complex environment, the project will support a comprehensive monitoring and morphological assessment of the Bangladesh Delta. A program to extend the current monitoring systems in Coastal Bangladesh is also essential to generate data, information, and new knowledge for assessments of effects of multiple drivers on the environment of coastal zone and guide future design, rehabilitation and improvement requirements. The monitoring will cover sediment rates and composition; erosion rates; sea level rise; subsidence rates; tidal dynamics changes; river cross section changes and meander migration; shoreline changes; and any relevant geomorphological attributes.

22. This work will be carried out by key institutions in Bangladesh, such as IWM, CEGIS, Dhaka University, BUET, and BWDB, in cooperation and twining arrangements with international institutions and experts in the topic of estuarine and coastal morphology and geomorphology. This twining arrangement is needed to build in-house capacity and guide local institutions and experts to improve their understanding of the physical processes of such a complex delta system. The project will support the installation and operation of needed equipment and systems on the ground, technical expertise, provision of advanced technology and equipment, high resolution specialized remote sensing images, and the capability to analyze these images. The project will support procurement of goods, services, and incremental operation costs in carrying out this research and analysis, and the development of databases and information systems that will be made available widely both within and outside of Bangladesh.

Component D – Project Management, Technical Assistance, Training and Strategic Studies (US$21 million).

23. This component will support BWDB in implementing the project through the establishment of a fully functioning Project Management Unit (PMU). It will provide resources for needed strategic studies (including the continuous updating of the strategic polder assessment as well as all necessary preparatory studies for following phases of the CEIP), institutional capacity building, technical assistance and training.

Component E – Contingent Emergency Response Component ($0 million)

24. In case of a major natural disaster, the Government may request the Bank to re-allocate project funds to this component (which presently carries a zero allocation) to support response and reconstruction[8]. This component would allow the Government to request the Bank to cancel project funds from Immediate Response Mechanism (IRM) portfolio projects and designate them as IRM funds to be engaged to partially cover emergency response and recovery costs. This component could also be used to channel additional funds should they become available as a result of the emergency.

25. Disbursements under an Contingent Emergency Response Component (CERC) will be contingent upon the fulfillment of the following conditions: (i) the Government of Bangladesh has determined that an eligible crisis or emergency has occurred and the Bank has agreed and notified the Government; (ii) the Ministry of Finance has prepared and adopted the Contingent Emergency Response (CER) Implementation Plan that is agreed with the Bank; (iii) Bangladesh Water Development Board has prepared, adopted, and disclosed safeguards instruments required as per Bank guidelines for all activities from the CER Implementation Plan for eligible financing under the CERC.

[8] Such a reallocation would not constitute a formal Project Restructuring.

26. Disbursements would be made either against a positive list of critical goods and/or against the procurement of works, and consultant services required to support the immediate response and recovery needs of the GoB. All expenditures under this component, should it be triggered, will be in accordance with BP/OP 8.0 and will be appraised, reviewed and found to be acceptable to the Bank before any disbursement is made.

Table 2-1: Estimated project cost by component (US$ million)

Project Component	Total Base cost	Total Cost Incl. Contingencies
A. Rehabiliation and Improvement of Polders		
A1. Rehabilitation and Improvemet of Polders	231	286
A2. Afforestation	4	5
Sub-total A		**291**
B. Implementaton of SAP and EMP		
B1. Social Action Plan (SAP)	2	3
B2. Resettlement Action Plan (RAP)	36	49
B2. Environmental Management Plan (EMP)	3	4
Sub-Total B	41	**56**
C. Construction Supervision, M&E, Delta Monitoring		
C1 Construction supervision	13	16
C2 M&E and supervision of RAP and EMP	3	4
C3 Long term Delta monitoring, reseach and anlysis	10	12
Sub-total C	**26**	**32**
D. Project Management, TA, Training, Strategic Studies		
D1 Project management support and audits	11	14
D2 BWDB strengthening, TA, Training	4	5
D3 Strategic studies, future project preparation	2	2
Sub-total D	**17**	**21**
E. Contingent Emergency Response	0	0
Base Cost	**319**	**400**
Physical Contingencies	44	-
Price Contingencies	37	-
Total	**400**	**400**

2.3 Proposed Interventions of CEIP with Possible Environmental Concern

27. The project will support 5 major components. Component A – Rehabilitation and Improvement of Polders and Component B: Implementation of Social Action and Environmental Management Plan are expected to have direct environmental and social impacts. Component C- Supervision and Monitoring and Evaluation of Project Impact and Component D – Project Management, Technical Assistance, Training and Strategic Studies may qualitatively facilitate in EMP implementation monitoring and environmental capacity building respectively. No fund has been allocated now for Component E – Contingent Emergency Response and if the project requires any polder rehabilitation due to any natural disaster, environmental screening will be included there. The CEIP project will consists of typical interventions for improving the embankment locally named as polders which are explained below:

(a) Embankment raising/repairing breaching points: Most of the embankments of coastal polders were constructed many years back and has subsided naturally and therefore existing crest level is reduced from the design level. Also, some parts of embankments breached due to tidal/ storm surges during

cyclone. Therefore, almost all embankments need to be raised and the breaching point should be repaired considering the present and future scenarios of tidal/ storm surge level. This will be one of the major interventions under CEIP project. This intervention will include mainly earthworks. It may need to re-align the existing embankment, usually to provide additional setback to avoid on-going \bank erosion. This could cause additional disruption to some existing settlements, beyond the strip of land required for raising crest levels.

(b) Construction/repairing of regulator and drainage cum flushing-inlet/sluice: Regulators and drainage cum flushing inlets/ sluices of many polders are not functioning properly due to natural sedimentation and poor maintenance of the structures. These structures will be rehabilitated under CEIP project to improve the drainage system in the polders. Improvement of these structures will involve mainly civil construction works, installation of equipments and shifting drainage channel (in some cases to rehabilitate the old regulators). The improved structures are to be designed to accommodate higher precipitation and effect of sea level rise on river levels due to climate change.

(c) Drainage channel re-excavation: Drainage channels in most of the coastal polders have been silted up which needs to be re-excavated to improve the drainage condition in the polder areas. The major activities for drainage channel re-excavation include dredging and disposal of spoil.

(d) Repairing/ constructing inlet: Many inlets in the drainage and irrigation channels of coastal polders will be repaired or newly constructed to maintain the drainage and irrigation facilities in the polder area. Major activities for this intervention include earthworks and civil construction.

(e) Constructing channel closure regulator: Closure Regulator may be required in some channels of coastal polders to protect from tidal/ storm surge. Closure Regulator construction will mainly include earthworks and a discharge structure to accommodate the drainage blocked by the dam.

(f) Afforestation: The component will support in secondary maintenance schemes for improved O&M, embankment afforestation for protection of embankment toe against erosion. The species for plantation should be selected appropriately. Species selection of trees on the slopes of the embankment will commence after the completion of earthworks in restored and new embankments.

(g) Environmental Management Plan: The project has incorporated implementation of Environmental Management Plan as one of the components. The project is recognizing importance of environmental management in the rehabilitation of coastal polders which is a positive direction of recognizing the importance of environmental management in project implementation.

Chapter 3 : Environmental Policies, Legal and Administrative Framework

3.1 Relevant Government Policies, Acts, Rules and Strategy

28. The importance of' environmental consideration related to construction as well as rehabilitation projects has been recognized in a number of national documents that set the legal and regulatory framework for management of the water resources environment. In addition, 'Guidelines for Environmental Assessment of Water Management, 2001' prepared by the Water Resources Planning Organization (WARPO) under National Water Management Plan Project is a useful reference document. The major water resources management related policies are described briefly:

3.1.1 Environmental policy, 1992

29. The National Environmental Policy (NEPo) is one of the key and earlier policy documents of the Government. The policy addresses 15 sectors in all, in addition to providing directives on the legal framework and institutional arrangements. Coastal and marine environment is one of the sectors. The policy declarations that have particular bearing on the Integrated Coastal Zone Management (ICZM) are highlighted below:

- Sustainable use of coastal & marine resources and preservation of coastal ecosystem
- Prevention of national and international activities causing pollution in coastal and marine environment
- Strengthening research in protection and development of coastal & marine resources and environment
- Exploration of coastal and marine fisheries to a maximum sustainable limit

The policy also stated regarding 'Water development, flood control and irrigation' sector to:

- ensure environmentally-sound utilization of all water resources:
- ensure that water development activities and irrigation networks do not create adverse environmental impact;
- ensure that all steps are taken for flood control, including construction of embankments, dredging of rivers, digging of canals, etc, be environmentally sound at local, zonal and national levels;
- ensure mitigation measures of adverse environmental impact of completed water resources development and flood control projects;
- keep the rivers, canals, ponds, lakes, haors, baors and all other water bodies and water resources free from pollution;
- ensure sustainable, long-term, environmentally sound and scientific exploitation and management of the underground and surface water resources; and
- conduct environmental impact assessment before undertaking projects for water resources development and management.

30. The CEIP project interventions should comply with all these policy directives emphasizing particularly on reducing adverse environmental impacts. The EMF and EIA studies of the coastal polders should clearly address the potential impacts and possible mitigation measures.

3.1.2 National Environment Management Action Plan, 1995

31. The National Environment Management Action Plan (NEMAP, 1995) identified the main national environmental issues, including those related to the water sector. The main water related national concerns included flood damage, riverbank erosion, environmental degradation of water bodies, increased water pollution, shortage of irrigation water and drainage congestion; various specific regional concerns were also identified.

3.1.3 Bangladesh Environmental Conservation Act (ECA), 1995

32. The Environmental Conservation Act (ECA) of 1995 is the main legislative framework document relating to environmental protection in Bangladesh. This umbrella Act includes laws for conservation of the environment, improvement of environmental standards, and control and mitigation of environmental pollution. This Act established the Department of Environment (DoE), and empowers its Director

General to take measures as he considers necessary which includes conducting inquiries, preventing probable accidents, advising the Government, coordinating with other authorities or agencies, and collecting & publishing information about environmental pollution. According to this act (Section 12), no industrial unit or project shall be established or undertaken without obtaining, in a manner prescribed by the accompanying Rules, an Environmental Clearance Certificate (ECC) from the Director General of DOE. As per this act, the CEIP project will need to be cleared by DoE before implementation of the project following procedures given in the Environmental Conservation Rules (ECR) 1997. Also the Ecologically Critical Areas in coastal zone, defined by DoE under this act, should be considered while planning and designing of the CEIP project interventions.

3.1.4 Bangladesh Environmental Conservation Act (ECA), (Amendments) 2010

33. The ECA 1995 was amended in 2010, which provided clarification of defining wetlands and Ecologically Critical Areas as well as included many important environmental concerns such conservation wetlands, hill cutting, ship breaking, and hazardous waste disposal. This amendment empowered the government to enforce more penalties than before. Moreover, affected persons were given provision for putting objections or taking legal actions against the polluters or any entity creating nuisance to affected person.

3.1.5 Bangladesh Environmental Conservation Rules (ECR), 1997

34. The Environment Conservation Rules, 1997 were issued by the Government of Bangladesh in exercise of the power conferred under the Environment Conservation Act (Section 20), 1995. Under these Rules, the following aspects, among others, are covered:

(i) Declaration of ecologically critical areas
(ii) Classification of industries and projects into 4 categories
(iii) Procedures for issuing the Environmental Clearance Certificate
(iv) Determination of environmental standards

35. The Rule 3 defines the factors to be considered in declaring an area 'ecologically critical area' (ECA) as per Section 5 of ECA'95. The Government can declare an area 'ECA', if it is satisfied that the ecosystem of the area has reached or is threatened to reach a critical state or condition due to environmental degradation. The Government is also empowered to specify which of the operations or processes shall be carried out or shall not be initiated in the ecologically critical area. Under this mandate, MoEF has declared Sundarban, Cox's Bazar-Teknaf Sea Shore, Saint Martin Island, Sonadia Island, Hakaluki Haor, Tanguar Haor, Marzat Baor and Gulshan-Baridhara Lake as ECA and prohibited certain activities in those areas. Beside these, recently the government of Bangladesh has declared four rivers such as Buriganga River, Turag River, Shitolakha River and Balu River around the Dhaka City as ECA.

36. ECR'97 (Rule 7) classifies industrial units and projects into four categories depending on environmental impact and location for the purpose of issuance of ECC. These categories are: Green, Orange A, Orange B and Red.

37. All existing industrial units and projects and proposed industrial units and projects, that are considered to be low polluting are categorized under "Green" and shall be granted Environmental Clearance. For proposed industrial units and projects falling in the Orange-A, Orange-B and Red Categories, firstly a site clearance certificate and thereafter an environmental clearance certificate will be issued. A detailed description of those four categories of industries has been given in Schedule-1 of ECR'97. Apart from general requirement, for every Red category proposed industrial unit or project, the application must be accompanied with feasibility report on IEE, EIA based on approved ToR by DoE, EMP etc.

38. The ECR'97 describes the procedures for obtaining Environmental Clearance Certificates (ECC) from the Department of Environment for different types of proposed units or projects. Any person or organization wishing to establish an industrial unit or project must obtain ECC from the Director General. The application for such certificate must be in the prescribed form together with the prescribed fees laid

down in Schedule 13, through the deposit of a Treasury Chalan in favor of the Director General. The fees for clearance certificates are revised in 2010. Rule 8 prescribes the duration of validity of such certificate (3 years for green category and 1year for other categories) and compulsory requirement for renewal of certificate at least 30 days before expiry of its validity.

3.1.6 Bangladesh Environment Court Act, 2010

39. Bangladesh Environment Court Act, 2010 was enacted in view of resolving the disputes and establishing justice over environmental and social damage raised due to any development activities. This act allows government to take necessary legal action against any parties who creates environmental hazards/ damage to environmentally sensitive areas as well as human society. According to this act, government can take legal actions if any environmental problem occurs due to CEIP project interventions.

3.1.7 National Water Policy, 1999

40. The National Water Policy was endorsed by the government in 1999 with the aim of providing guidance to the major players in water sector for ensuring optimal development and management of water. According to the policy, all agencies and departments entrusted with water resource management responsibilities (regulation, planning, construction, operation, and maintenance) will have to enhance environmental amenities and ensure that environmental resources are protected and restored in executing their tasks.

41. The policy has several clauses related to water resource development projects for ensuring environmental protection. Some of the relevant clauses are:

Clause 4.5b: Planning and feasibility studies of all projects will follow the Guidelines for Project Assessment, the Guidelines for People's Participation (GPP), the Guidelines for Environmental Impact Assessment, and all other instructions that may be issued from time to time by the Government.

Clause 4.9b: Measures will be taken to minimize disruption to the natural aquatic environment in streams and water channels.

Clause 4.9e: Water development plans will not interrupt fish movement and will make adequate provisions in control structures for allowing fish migration and breeding.

Clause 4.10a: Water development projects should cause minimal disruption to navigation and, where necessary, adequate mitigation measures should be taken.

Clause 4.12a: Give full consideration to environmental protection, restoration and enhancement measures consistent with National Environmental Management Action Plan (NEMAP) and the National Water Management Plan (NWMP).

Clause 4.12b: Adhere to a formal environmental impact assessment (EIA) process, as set out in EIA guidelines and manuals for water sector projects, in each water resources development project or rehabilitation program of size and scope specified by the Government from time to time.

Clause 4.12c: Ensure adequate upland flow in water channels to preserve the coastal estuary eco-system threatened by intrusion of salinity from the sea.

Clause 4.13b: Only those water related projects will be taken up for execution that will not interfere with aquatic characteristics of those water bodies.

42. Although CEIP project interventions will be implemented in already built coastal polders, the environmental impact assessment and environmental management should be taken care of for the project as per the National Water Policy.

3.1.8 National Water Management Plan, 2001 (Approved in 2004)

43. The National Water Management Plan (NWMP) 2001, approved by the National Water Resources Council in 2004, was envisioned to establish an integrated development, management and use of water resources in Bangladesh over 25 years. Water Resources Planning Organization (WARPO) was assigned to monitor the national water management plan. The major programs in the plan have been presented under eight sub-sectoral clusters: i) Institutional Development, ii) Enabling Environment, iii) Main

River, iv) Towns and Rural Areas, v) Major Cities; vi) Disaster Management; vii) Agriculture and Water Management, and viii) Environment and Aquatic Resources. Each cluster comprises of a number of individual programs, with overall a total of 84 sub-sectoral programs identified and presented in the investment portfolio. Most of the programs may be implemented in coastal areas. Out of 84 programs, particularly AW 007: Rationalization of existing FCD infrastructures; and AW008: Land reclamation, coastal protection and afforestation programs as well as programs related to institutional capacity building of BWDB for water management are related to CEIP project. Part of these programs (e.g. AW007, AW008) was implemented under different projects. CEIP project will also contribute partial implementation of these programs in the coastal area.

3.1.9 Coastal Zone Policy, 2005

44. The Government has formulated the coastal zone policy (CZPo) that would provide a general guidance to all concerned for the management and development of the coastal zone in a manner so that the coastal people are able to pursue their life and livelihoods within secure and conducive environment.

45. The coast of Bangladesh is prone to natural disasters like cyclone, storm surge and flood. In this regard, for reducing risk, the policy emphasized the improvement of coastal polders as stated in section 4.3 (e): Safety measures will be enhanced by combining cyclone shelters, multi-purpose embankments, killas, road system and disaster warning system. But, the policy does not indicate the environmental assessment for the development project in the coastal area.

3.1.10 Coastal Development Strategy, 2006

46. The Coastal Development Strategy (CDS) focuses on the implementation of the coastal zone policy. The CDS was approved at the second meeting of the Inter-Ministerial Steering Committee on ICZMP held on 13 February 2006. Nine strategic priorities, evolved through a consultation process, guides interventions and investments in the coastal zone:

- ensuring fresh and safe water availability
- safety from man-made and natural hazards
- optimizing use of coastal lands
- promoting economic growth emphasizing non-farm rural employment
- sustainable management of natural resources: exploiting untapped and less explored
- opportunities
- improving livelihood conditions of people; especially women
- environmental conservation
- empowerment through knowledge management
- creating an enabling institutional environment

47. The interventions under second strategy “safety from man-made and natural hazards” include improvement of coastal polders and sea dykes. The proposed CEIP project interventions are in line with this strategy.

3.1.11 National land use policy (MoL, 2001)

48. The National Land Use Policy (NLUPo), enacted in 2001, was aimed to managing land use effectively to support trends in accelerated urbanization, industrialization and diversification of development activities. The NLUPo urges that increasing the land area of the country may be not possible through artificial land reclamation process, which is cost-effective only in the long run. Therefore, land use planning should be based on the existing and available land resources. The policy suggests establishing land data banks where, among others, information on accreted riverine and coastal chars will be maintained. Among the 28 policy statements of NLUPo, the followings are relevant to coastal area:

- forests declared by the Ministry of Forests and Environment will remain as forest lands;
- reclassification of forest lands will be prevented; and
- effective green belts will be created all along the coast.

49. The NLUPo can play key role for the future developments in the coastal zone. Nevertheless, the NLUPo does not provide policy directives for resolving land use conflicts and land zoning in the country (including in the coastal zone).

50. The CEIP project will drive the landuse changes in the coastal polder due to protection from flood/tidal surges. As per the NLUPo, effective landuse management will be required in future through the local government to sustain optimum land resource for diversified development activities.

3.1.12 National Agriculture Policy, 1999

51. The overall objective of the National Agriculture Policy is to make the nation self-sufficient in food through increasing production of all crops including cereals and ensure a dependable food security system for all. Although the policy does not emphasize the coastal zone separately, all specific objectives are applicable to the development of coastal zone agriculture. The policy particularly stressed on minor irrigation capturing tidal water in reservoirs in coastal areas and research on the development of improved varieties and technologies for cultivation in coastal, hilly, water-logged and salinity affected areas. The policy also recognizes that adequate measures should be taken to reduce water-logging, salinity and provide irrigation facilities for crop production.

3.1.13 National Fisheries Policy, 1996

52. The National Fisheries Policy, 1996 recognizes that fish production has declined due to environmental imbalances, adverse environmental impact and improper implementation of fish culture and management programs. The policy particularly focuses on coastal shrimp, aquaculture and marine fisheries development. The policy suggests following actions:

- Shrimp and fish culture will not he expanded to the areas which damage mangrove forest in the coastal region
- Biodiversity will be maintained in all natural water bodies and in marine environment
- Chemicals harmful to the environment will not be used in fish shrimp farms
- Environment friendly fish shrimp culture technology will be used
- Expand fisheries areas and integrate rice, fish and shrimp cultivation
- Control measures will be taken against activities that have a negative impact on fisheries resources and vice-versa
- Laws will be formulated to ban the disposal of any untreated industrial effluents into the water bodies.

3.1.14 National Livestock Development Policy, 2007

53. The National Livestock Development Policy has been prepared to address the key challenges and opportunity for a comprehensive sustainable development of the Livestock subsector by creating an enabling policy framework. The LDPo does not recognize the coastal zone separately. Among 60 or more policy statements, the following two policy statements contain the mentioning of the coastal zone.

- Specific areas will be identified to implement programs for fattening of cattle and livestock. For this purpose, the Chittagong Hill Tracts, the coastal areas and the islands will be included under the fattening of livestock and cattle program.
- Special programs will be taken up for the production of grass in the Chittagong Hill-tracts and the coastal areas.

3.1.15 Forestry Acts

50. Systematic management of forests started in the 1860s after the establishment of a Forest Department in the Province of Bengal. To regulate activities within forests, rules and regulations have been formulated, amended, modified and improved upon over the years. These rules and regulations are formulated on the basis of long-existing acts and policies.

51. Forest legislation in Bangladesh dates back to 1865, when the first Indian Forest Act was enacted. It provided for protection of tree, prevention of fires, prohibition of cultivation, and grazing in forest areas. Until a comprehensive Indian Forest Act was formulated in 1927, several acts and amendments covering forest administration in British India were enacted and were as follows: (a) Government Forest Act, 1865; (b) Forest Act, 1890; (c) Amending Act, 1891; (d) Indian Forest (Amendment) Act, 1901; (e) Indian Forest (Amendment) Act, 1911; (f) Repealing and Amending Act, 1914; (g) Indian Forest Amendment Act, 1918; and (h) Devolution Act, 1920.

52. The Forest Act of 1927, as amended with its related rules and regulations, is still the basic law governing forests in Bangladesh. The emphasis of the Act is on the protection of reserved forest. Some important features of the Act are: (i) Under the purview of the Forest Act, all rights or claims over forestlands have been settled at the time of the reservation. The Act prohibits the grant of any new rights of any kind to individuals or communities; (ii) Any activity within the forest reserves is prohibited, unless permitted by the Forest Department; (iii) Most of the violations may result in court cases where the minimum fine is Taka 2,000 and/or two month's rigorous imprisonment; and (iv) The Act empowers the Forest Department to regulate the use of water-courses within Reserve Forests.

3.1.16 Forest Act 1927 (Amendment 2000)

53. The Forest Act of 1927 as amended in 1989 has its roots in Indian Forest Act, 1878. The Forest Act grants the government several basic powers, largely for conservation and protection of government forests, and limited powers for private forests. The 1927 version of the act was amended in 1989 for extending authority over "any [Government-owned] land suitable for afforestation".

54. Forest department is the main agency to implement the provisions of the Forest Act. The Act, however, does not specify any sort of institutional structure for the forest or other land holding agencies. It also does not set out any specific policy direction for managing the forests.

55. Most of the forest lands under the management of forest department are areas declared to be reserved and protected forests under this act. The act empowers the government to regulate the felling, extraction, and transport of forest produce in the country.

3.1.17 Private Forest Ordinance (PFO), 1959

56. The Private Forest Act of 1959 allows the Government to take over management of improperly managed private forest lands, any private lands that can be afforested, and any land lying fallow for more than three years. The Private Forest Ordinance was originally enacted in 1945, as the Bengal Private Forest Act, and was re-enacted by the Bangladesh (then East Pakistan) in 1949 before being issued as an Act in 1959. These government managed lands under this act are called "vested forests". The Forest Department manages approximately 8,500 hectares in the country as "vested forests". This area is relatively small, but the area historically affected by this law is much larger.

57. PFA, 1959 empowers the government to require management plans for private forests and to assume control of private forests as vested forests. Government has broad powers to write rules regarding use and protection of vested forests, and apply rules to "controlled forests," which include all private forests subject to any requirement of the Act.

3.1.18 Private Forest Policy 1994

58. The policy suggested for extended effort to bring about 20% of the country's land under the afforestation programs of the government and private sector by year 2015 by accelerating the pace of the program through the coordinated efforts of the government and NGOs and active participation of the people in order to achieve self reliance in forest products and maintenance of ecological balance. The policy viewed equitable distribution of benefits among the people, especially those whose livelihood depend on trees and forests; and people's participation in afforestation programs and incorporation of people's opinions and

suggestions in the planning and decision-making process. The people-centered objectives of the policy are: creation of rural employment opportunities and expansion of forest-based rural development sectors; and prevention of illegal occupation of forest lands and other forest offences through people's participation. The policy statements envisage: massive afforestation on marginal public lands through partnerships with local people and NGOs; afforestation of denuded/encroached reserved forests with an agroforestry model through participation of people and NGOs; giving ownership of a certain amount of land to the tribal people through forest settlement processes; strengthening of the Forest Department; strengthening of educational, training and research facilities; and amendment of laws, rules and regulations relating to the forestry sector and if necessary, promulgation of new laws and rules. Thus, over time the policy has shifted somewhat from total state control to a management regime involving local communities in specific categories of forests.

59. Because of limited amount of forestland, the policy underscores for effective measures for afforestation in rural areas, in the newly accreted char in the coastal areas and in the denuded Unclassed State Forest areas of Chittagong Hill Tract and northern zone of the country including the Barind tract. The policy also encourages the private sector participation in afforestation.

3.1.19 Social Forestry Rules, 2004 and Amendments

60. Social forestry was included in the Forest (Amendment) Act 2000 and the Social Forestry Rules were approved in 2004 (amended in 2010 and 2011). The Rules defined the process of beneficiaries' selection, roles and responsibilities of different stakeholders, management, capacity building and distribution of earnings from social afforestation. According to the rules, the beneficiaries shall be selected from amongst the local communities and shall preferably be from the amongst the followings persons, namely: (a) landless persons; (b) owners or occupants of less than 50 decimals of land; (c) destitute women; (d) unprivileged community; (e) poor ethnic minority; (f) poor forest villages; and (g) insolvent freedom fighters or insolvent successor of freedom fighters. The rules provided the rotation period for different plantation and benefit sharing. In general, the communities responsible for maintenance of plantation will receive around 45% of timber value of the forest.

3.1.20 Standing Orders on Disaster, 2010

61. The Standing Orders on Disaster' is designed to enhance capacity at all tiers of government administrative and social structures for coping with and recovering from disasters. The document contains guidelines for construction, management, maintenance and use of cyclone shelter center. Accordingly to the guideline, geographical information system (GIS) technology will be applied at the planning stage to select the location of cyclone shelter considering habitation, communication facilities, distance from the nearest cyclone centre etc. The advice of the concerned District Committee is to be obtained before final decision. The cyclone shelters should have easier communication facilities so that in times of distress delay does not occur to go there. For this reason, the road communication from the cyclone shelters should not only link up with city or main road but also with neighboring village areas. Provision of emergency water, food and sanitation and shelter space for livestock during period should also be kept in view for future construction of shelters.

3.1.21 National Adaptation Programme of Action (NAPA)

62. In 2005, the Ministry of Environment and Forest (MoEF), Government of the People's Republic of Bangladesh has prepared the National Adaptation Program of Action (NAPA) for Bangladesh, as a response to the decision of the Seventh Session of the Conference of the Parties (CoP7) of the United Nations Framework Convention on Climate Change (UNFCCC). The basic approach to NAPA preparation was along with the sustainable development goals and objectives of the country where it has recognized necessity of addressing climate change and environmental issue and natural resource management. The NAPA is the beginning of a long journey to address adverse impacts of climate change including variability and extreme events and to promote sustainable development of the country. There are 15 adaptation strategies have been suggested for Bangladesh to address adverse effects of climate change. Among the 15 adaptation strategies the following strategies have taken for the coastal region for reducing climate change induced vulnerability.

- Reduction of climate change hazards through coastal afforestation with community participation

- Providing drinking water to coastal communities to combat enhanced salinity due to sea level rise
- Construction of flood shelter, and information and assistance centre to cope with enhanced recurrent floods in major floodplains
- Promotion of research on drought, flood and saline tolerant varieties of crops to facilitate adaptation in future
- Promoting adaptation to coastal crop agriculture to combat increased salinity
- Promoting adaptation to coastal fisheries through culture of salt tolerant fish special in coastal areas of Bangladesh

3.1.22 Bangladesh Climate Change Strategy and Action Plan (BCSAP) 2009

63. The Government of Bangladesh has prepared the Bangladesh Climate Change Strategy and Action Plan (BCCSAP), 2009. The BCCSAP is built on six pillars:

- **Food security, social protection and health** to ensure that the poorest and most vulnerable in society, including women and children, are protected from climate change and that all programs focus on the needs of this group for food security, safe housing, employment and access to basic services, including health.
- **Comprehensive disaster management** to further strengthen the country's already proven disaster management systems to deal with increasingly frequent and severe natural calamities.
- **Infrastructure** to ensure that existing assets (e.g., coastal and river embankments) are well maintained and fit for purpose and that urgently needed infrastructures (cyclone shelters and urban drainage) is put in place to deal with the likely impacts of climate change.
- **Research and Knowledge management** to predict that the likely scale and timing of climate change impacts on different sectors of economy and socioeconomic groups; to underpin future investment strategies; and to ensure that Bangladesh is networked into the latest global thinking on climate change.
- **Mitigation and low carbon development** to evolve low carbon development options and implement these as the country's economy grows over the coming decades.
- **Capacity building and Institutional strengthening** to enhance the capacity government ministries, civil society and private sector to meet the challenge of climate change.

64. Three program have been suggested for improvement (repair and rehabilitation) of the existing coastal polders of Bangladesh under pillar 3 (Infrastructure) of BCCSAP. The CEIP project will further contribute to achieve objective of other pillars such as (i), (ii) and (iv).

3.1.23 The Embankment and Drainage Act, 1952

65. The *East Bengal Act No. 1*, 1953 was amended in 1953 which has been adapted by the People Republic of Bangladesh, by the Bangladesh Order (adaptation of Existing Laws), 1972 (President's Order No. 48 of 1972). The Act consolidates the laws relating to embankments and drainage providing provision for the construction, maintenance, management, removal and control of embankments and water courses for the better drainage of lands and for their protection from floods, erosion or other damage by water. The specific Sections and Articles relevant to the Project are mentioned below:

- Section 4 (1) of the Act states that the embankment, water-course, and tow-path, earth, pathways, gates, berms and hedges of the embankments shall vest in the Government of the Authority (BWDB).
- Section 56 (1) states that, person will be subject to penalty (500 taka or imprisonment… if he erects, or causes of willfully permits to be erected, any new embankment, or any existing embankment, or obstructs of diverts, or causes or willfully permits to be obstructed or diverted, any water course.
- Section 15 allows for the engineer (engineer in charge of Divisional level BWDB) for constructing new embankment or enlarging, lengthening or repairing existing embankments.

- The other sections of the Act give powers and access to the Government or Authority or Engineers to commence necessary Project activities, for land acquisition (through the Deputy Commissioner), and site clearing activities including removal of trees or houses (if necessary).

3.1.24 Bangladesh Labor Act, 2006

66. The Bangladesh Labor Act, 2006 provides the guidance of employer's extent of responsibility and workmen's extent of right to get compensation in case of injury by accident while working. Some of the relevant Sections are:

- ***Section 150. Employer's Liability for Compensation:*** (1) If personal injury is caused to a workman by accident arising out of and in the course of his employment, his employer shall be liable to pay compensation in accordance with the provisions of this Act; and (2) Provided that the employer shall not be so liable - (a) in respect of any injury which does not result in the total or partial disablement of the workman for a period exceeding three days; (b) in respect of any injury, not resulting in death or permanent total disablement, caused by an accident which is directly attributable to - (i) the workman having been at the time thereof under the influence of drink or drugs, or (ii) the willful disobedience of the workman to an order expressly given, or to a rule expressly framed, for the purpose of securing the safety of workmen, or (iii) the willful removal or disregard by the workman of any safety guard or other device which he knew to have been provided for the purpose of securing the safety of workmen.
- ***Section 151.*** (1) *Amount of Compensation:* Subject to the provisions of this Act, the amount of compensation shall be as follows, namely :- (a) where death results an amount equal to fifty from the injury cent of the monthly wages of the deceased workman multiplied by the relevant factor; or an amount of fifty thousand rupees, whichever is more; (b) where permanent total an amount equal to disablement results from sixty the injury per cent of the monthly wages of the injured workman multiplied by the relevant

3.1.25 Bangladesh National Building Code, 2006

67. Part-7, Chapter -1 of the Bangladesh National Building Code (BNBC) clearly sets out the constructional responsibilities according to which the relevant authority of a particular construction site shall adopt some precautionary measures to ensure the safety of the workmen. According to section 1.2.1 of chapter 1 of part 7, "In a construction or demolition work, the terms of contract between the owner and the contractor and between a consultant and the owner shall be clearly defined and put in writing. These however will not absolve the owner from any of his responsibilities under the various provisions of this Code and other applicable regulations and bye-laws. The terms of contract between the owner and the contractor will determine the responsibilities and liabilities of either party in the concerned matters, within the provisions of the relevant Acts and Codes (e.g.) the Employers' Liability Act, 1938, the Factories Act 1965, the Fatal Accident Act, 1955 and Workmen's Compensation Act 1923". (After the introduction of the Bangladesh Labor Act, 2006, these Acts have been repealed).

68. Section 1.4.1 of chapter-1, part-7 of the BNBC, states the general duties of the employer to the public as well as workers. According to this section, "All equipments and safeguards required for the construction work such as temporary stair, ladder, ramp, scaffold, hoist, run way, barricade, chute, lift etc shall be substantially constructed and erected so as not to create any unsafe situation for the workmen using them or the workmen and general public passing under, on or near them".

69. Part-7, Chapter-3 of the Code has clarified the issue of safety of workmen during construction and with relation to this, set out the details about the different safety tools of specified standard. In relation with the health hazards of the workers during construction, this chapter describes the nature of the different health hazards that normally occur in the site during construction and at the same time specifies the specific measures to be taken to prevent such health hazards. According to this chapter, exhaust ventilation, use of protective devices, medical checkups etc. are the measures to be taken by the particular employer to ensure a healthy workplace for the workers.

70. To prevent workers falling from heights, the Code in section 3.7.1 to 3.7.6 of chapter 3 of part 7 sets out the detailed requirements on the formation and use of scaffolding. According to section 3.9.2 of the same chapter, "every temporary floor openings shall either have railing of at least 900 mm height or shall be constantly attended. Every floor hole shall be guarded by either a railing with toe board or a hinged cover. Alternatively, the hole may be constantly attended or protected by a removable railing. Every stairway floor opening shall be guarded by railing at least 900 mm high on the exposed sides except at entrance to stairway. Every ladder way floor opening or platform shall be guarded by a guard railing with toe board except at entrance to opening. Every open sided floor or platform 1.2 meters or more above adjacent ground level shall be guarded by a railing on all open sides except where there is entrance to ramp, stairway or fixed ladder……the above precautions shall also be taken near the open edges of the floors and the roofs".

71. The major challenge is the proper implementation of the Code as section 2.1 of chapter 2 of part 1 duly states that, "The Government shall establish a new or designate an existing agency responsible for the enforcement of this Code with a given area of jurisdiction. For the purpose of administering and enforcing the provisions of the Code, the enforcing agency shall have the authority of the Government and shall herein be referred to as the Authority."

72. Part 9, 1.2.1 states that if the land is changed and the occupants of the area are against the change, no change in use of an existing building will be allowed.

3.2 Implication of GoB Polices, Acts and Rules on CEIP & Classification

72. The CEIP project intervention Legislative bases for environmental assessment in Bangladesh are the Environmental Conservation Act 1995 (ECA'95) and the Environmental Conservation Rules 1997 (ECR'97). Department of Environment (DOE), under the Ministry of Environment and Forest (MOEF), is the regulatory body responsible for enforcing the ECA'95 and ECR'97. According to the Rule 7 (1) of the Environmental Conservation Rules 1997; for the purpose of issuance of Environmental Clearance Certificate (ECC), every industrial units or projects, in consideration of their site and impact on the environment, will be classified into the four categories and they are: Category I (green), Category II (Orange-A), Category III (Orange B) and Category IV (Red). According to the categorization, all construction/reconstruction/expansion of flood control embankment/polder/dykes etc falls under Red Category. Therefore Coastal Embankment Improvement Project falls under the '**Red**' category.

73. It is the responsibility of the proponent to conduct an EIA of development proposal, the responsibility to review EIAs for the purpose of issuing Environmental Clearance Certificate (ECC) rests on DOE. The procedures for "Red" Category include submission of:

- **An Initial Environmental Examination (IEE)**
- **An Environmental Impact Assessment (EIA)**
- **An Environmental Management Plan (EMP)**

74. Environment clearance has to be obtained by the respective implementing agency or project proponent (private sector) from Department of Environment (DOE). The environmental clearance procedure for Red Category projects can be summarized as follows:

Application to DOE → Obtaining Site Clearance → Applying for Environmental Clearance → Obtaining Environmental Clearance → Clearance Subject to annual renewal

3.3 Detailed Steps of In Country Environmental Clearance Procedure

75. Legislative bases for EIA in Bangladesh are the Environmental Conservation Act 1995 (ECA'95) and the Environmental Conservation Rules 1997 (ECR'97). Department of Environment (DOE), under the Ministry of Environment and Forest (MOEF), is the regulatory body responsible for enforcing the ECA'95 and ECR'97. According to the Environment Conservation Act 1995 no industrial unit or project will be established or undertaken without obtaining, in the manner

prescribed by the Environment Conservation Rules 1997, an Environmental Clearance Certificate from the Director General. Therefore, every development projects/industries which are specified under the Schedule – 1 of the Environmental Conservation Rules 1997 require obtaining site clearance and environmental clearance from DoE. For 'Red' category, it is mandatory to carry out an EIA including an EMP and where necessary develop a Resettlement Plan for getting environmental clearance from DoE. The application procedure for obtaining site clearance and environmental clearance for the sub-projects of Red category is shown in Figure 3.1.

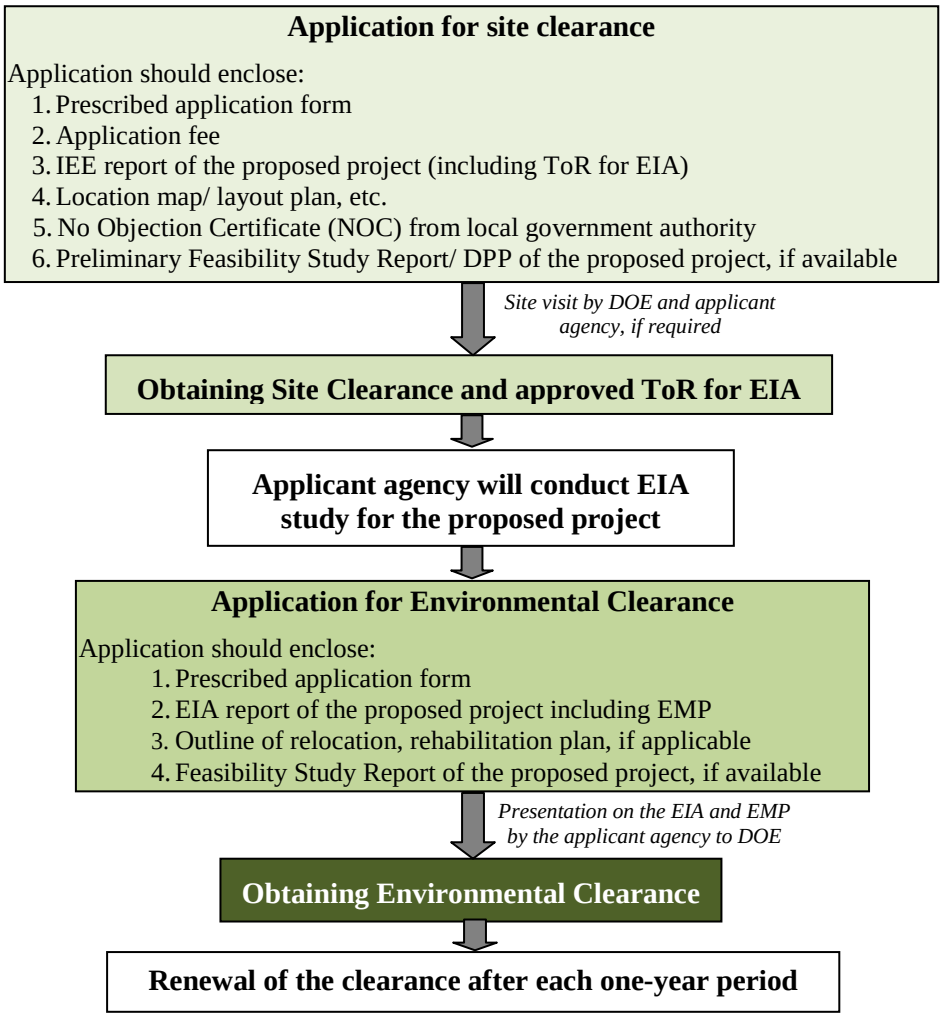


Figure 3-1: Process of obtaining Clearance certificate from DoE

3.4 World Bank's Environmental Safeguards Policy

3.4.1 General Description of World Bank Safeguard Policy

76. The World Bank has developed a number of Safeguard Operation Policies to ensure that all possible impacts are considered and mitigation measures are spelled out prior to the implementation of any proposed project. These policies ensure that the quality of operations is uniform across different settings worldwide. If the decision is taken that a Safeguard Policy should be applied, mitigation measures and plans must be developed and in place before the implementation of a proposed project.

77. The Bank requires environmental screening and classification for all investment projects[2] (including ones financed by Trust Funds, Project Preparation Facilities and Guarantees) proposed for Bank financing, to help ensure that they are environmentally and socially sound and sustainable. Screening and classification take into account the natural environment (air, water, and land); human health and safety; social aspects

(involuntary resettlement, Indigenous Peoples); cultural property; and transboundary and global environmental aspects.

78. The objectives of environmental screening and classification are: to evaluate the environmental risks associated with a proposed operation; to determine the depth and breadth of Environmental Assessment (EA); and to recommend an appropriate choice of EA instrument(s) suitable for a given project. The Bank recognizes that environmental screening and classification is not absolute and involves professional judgment on a case by case basis. When screening, careful consideration needs to be given to potential environmental impacts and risks associated with the proposed project. Judgment is exercised with reference to the policy expectations and guidance; real impacts on the ground; and established regional and Bank-wide precedence and good practice.

3.4.2 OP 4.01 Environmental Assessment

79. The World Bank requires environmental assessment (EA) of projects proposed for Bank support to ensure that they are environmentally sound and sustainable, and thus to improve decision making. EA is a process whose breadth, depth, and type of analysis depend on the nature, scale, and potential environmental impact of the proposed project. EA evaluates a project's potential environmental risks and impacts in its area of influence; examines project alternatives; identifies ways of improving project selection, siting, planning, design, and implementation by preventing, minimizing, mitigating, or compensating for adverse environmental impacts and enhancing positive impacts; and includes the process of mitigating and managing adverse environmental impacts throughout project implementation. EA takes into account the natural environment (air, water and land); human health and safety; social aspects (involuntary resettlement, indigenous peoples and physical cultural resources); and trans-boundary and global environmental aspects. The borrower is responsible for carrying out the EA and the Bank advises the borrower on the Bank's EA requirements.

80. The World Bank classifies the proposed project into three major categories, depending on the type, location, sensitivity, and scale of the project and the nature and magnitude of its potential environmental impacts.

Category A: The proposed project is likely to have significant adverse environmental impacts that are sensitive, diverse, or unprecedented. These impacts may affect an area broader than the sites or facilities subject to physical works.

Category B: The proposed project's potential adverse environmental impacts on human population or environmentally important areas-including wetlands, forests, grasslands, or other natural habitats- are less adverse than those of 'Category A' projects. These impacts are site specific; few if any of them are irreversible; and in most cases mitigation measures can be designed more readily than Category A projects.

Category C: The proposed project is likely to have minimal or no adverse environmental impacts.

3.4.3 OP 4.04: Natural Habitats

81. The policy describes the conservation of natural habitats, like other measures that protect and enhance the environment, is essential for long-term sustainable development. The Bank therefore supports the protection, maintenance, and rehabilitation of natural habitats and their functions in its economic and sector work, project financing, and policy dialogue. The Bank also supports, and expects borrowers to apply, a precautionary approach to natural resource management to ensure opportunities for environmentally sustainable development. The Bank- promotes and- supports natural habitat conservation and improved land use by financing projects designed to integrate into national and regional development the conservation of natural habitats and the maintenance of ecological functions. Furthermore, the Bank promotes the rehabilitation of degraded natural habitats. The Bank does not support projects that involve the significant conversion or degradation of critical natural habitats.

3.4.4 OP 4.07: Water Resources Management

82. The OP 4.07 policy is intended to ensure the international standard for water resources management. The Bank's involvement in water resources management entails support for providing potable

water, sanitation facilities, flood control, and water for productive activities in a manner that is economically viable, environmentally sustainable, and socially equitable. The Bank assists borrowers in many priority areas, among which developing a comprehensive framework for designing water resource investments, policies, and institutions is very important. Within this framework, when the borrower develops and allocates water resources, it considers cross-sectoral impacts in a regional setting (e.g., a river basin). Restoring and preserving aquatic ecosystems and guarding against overexploitation of groundwater resources are also given priority to the provision of adequate water and sanitation services for the poor. Furthermore, special attentions are needed by the borrowers to avoid the water logging and salinity problems associated with irrigation investments by (i) monitoring water tables and implementing drainage networks where necessary, and (ii) adopting best management practices to control water pollution.

3.4.5 OP 4.11: Physical Cultural Resources

83. Physical cultural resources are defined as movable or immovable objects, sites, structures, groups of structures, and natural features and landscapes that have archaeological, paleontological, historical, architectural, religious, aesthetic, or other cultural significance. Their cultural interest may be at the local, provincial or national level, or within the international community. Physical cultural resources are important as sources of valuable scientific and historical information, as assets for economic and social development, and as integral parts of a people's cultural identity and practices. The Bank assists countries to avoid or mitigate adverse impacts on physical cultural resources from development projects that it finances. The impacts on physical cultural resources resulting from project activities, including mitigating measures, may not contravene either the borrower's national legislation, or its obligations under relevant international environmental treaties and agreements. The borrower should address the impacts on physical cultural resources in projects proposed for Bank financing, as an integral part of the environmental assessment (EA) process.

3.4.6 OP 4.36: Forests

84. The OP 4.36 is concerned about the management, conservation, and sustainable development of forest ecosystems and their associated resources. The bank believe that forests are very much essential for poverty reduction and sustainable development irrespective of their location in the world. Since some part of the coastal zone of Bangladesh is covered by mangrove and other type of forest, the assessment of impacts of CEIP project on the forest ecosystems need special attention while doing environmental assessment.

85. The Bank assists borrowers with forest restoration activities that maintain or enhance biodiversity and ecosystem functionality. The Bank also assists borrowers with the establishment and sustainable management of environmentally appropriate, socially beneficial, and economically viable forest plantations to help meet growing demands for forest goods and services. The Bank does not finance projects that, in its opinion, would involve significant conversion or degradation of critical forest areas or related critical natural habitats. If a project involves the significant conversion or degradation of natural forests or related natural habitats that the Bank determines are not critical, and the Bank determines that there are no feasible alternatives to the project and its siting, and comprehensive analysis demonstrates that overall benefits from the project substantially outweigh the environmental costs, the Bank may finance the project provided that it incorporates appropriate mitigation measures. The Bank does not finance projects that contravene applicable international environmental agreements. The bank insist that the plantation projects should be designed carefully to avoid introduction of invasive species and threaten biodiversity.

3.4.7 IFC Environmental Health & Safety Guideline

86. The Environmental, Health and Safety (EHS) Guidelines of the International Finance Corporation (IFC), 2008 is the safeguard guidelines for environment, health and safety for the development of the industrial and other projects. They contain performance levels and measures that are considered to be achievable in new facilities at reasonable costs using existing technologies.

3.5 Implications of the World Bank Policies on CEIP & Environmental Category

87. The project is classified as a Category A project, due to the complexity of environmental issues associated with project activities involving major civil works by reconstruction and rehabilitation of the coastal embankment to protect against tidal flooding and storm surges. Since the coastal area is of high ecological sensitivity and vulnerability certain negative environmental impacts may occur during the implementation and operational phase on overall polder system. There may be localized impact on the natural habitats especially on the fish spawning site and protected areas, during the implementation of the civil works. Sundarbans the largest Mangrove forest of South Asia is in close proximity of the 6 districts of 17 polders. Rehabilitation and reconstruction of polders may have indirect impact on the water flow quantity and pattern within the channels of Sundarbans.

88. The environment assessment (OP/BP 4.01), natural habitats (OP/BP 4.04) and forests (OP/BP 4.36) policy have been triggered for the proposed operation. Although no direct impacts on physical cultural resources are expected, screening mechanism incorporated into the EA process will identify subprojects with archeological, paleontological, historical, religious, or unique natural values. Physical cultural resources (OP/BP 4.11) are considered in the environmental framework preparation.

3.6 'Public consultation and disclosure' requirements by World Bank

89. The Bank reaffirms its recognition and endorsement of the fundamental importance of transparency and accountability to the development process. Accordingly, it is Bank‟s policy to be open about its activities and to welcome and seek out opportunities to explain its work to the widest possible audience. According to 'OP 4.01: Environmental Assessment' of World Bank, the following conditions applies to the CEIP project.

Public Consultation:

90. For all Category A (e.g. CEIP project) projects the borrower should consult the project-affected groups and local nongovernmental organizations (NGOs) about the project's environmental aspects and takes their views into account. The borrower should initiate such consultations as early as possible. For Category A projects, the borrower should consult these groups at least twice: (a) shortly after environmental screening and before the terms of reference for the EA are finalized; and (b) once a draft EA report is prepared. In addition, the borrower should consult with such groups throughout project implementation as necessary to address EA-related issues that affect them.

Disclosure:

91. For a Category A project, the borrower should provide relevant information on project interventions in a timely manner prior to consultation and in a form and language that are understandable and accessible to the groups being consulted. The borrower should provide a summary of the proposed project's objectives, description, and potential impacts for the initial consultation. For consultation after the draft EA report is prepared, the borrower should provide a summary of the EA's conclusions. In addition, for a Category A project, the borrower makes the draft EA report available at a public place accessible to project-affected groups and local NGOs. For SILs and FI operations, the borrower/FI ensures that EA reports for Category A subprojects are made available in a public place accessible to affected groups and local NGOs.

92. Public availability of the EA report for Category A project in the borrowing country and official receipt by the Bank are prerequisites to Bank appraisal of these projects. Once the borrower officially transmits the Category A EA report to the Bank, the Bank distributes the summary (in English) to the executive directors (EDs) at least 120 days prior to the Board Date and makes the report available through its InfoShop.

Chapter 4 : Environmental and Social Baseline

4.1 Introduction

93. The coastal zone of Bangladesh covers about 39,600 km^2 comprising 14 districts (about 32% area of Bangladesh) and inhabited by about 31million people (adjusted population in 2010)[9]. The majority of the coastal area lies within the delta of the Ganges - Brahmaputra - Meghna (GBM) river system and has been formed by sedimentary deposits in recent geologic time. The study area of the project is the entire coastal polders of coastal region of Bangladesh. A total number of 139 polders in coastal area have been considered for the study (Figure 4.1). A small part of polder 26 falls in Jessore district, which is just outside coastal zone. List of the polders is given in Appendix - 1. Under this study, entire coastal zone is divided into four distinct zones as per previous study "Coastal Zone Water Management Program" presented in Figure 4.1. The four zones are:

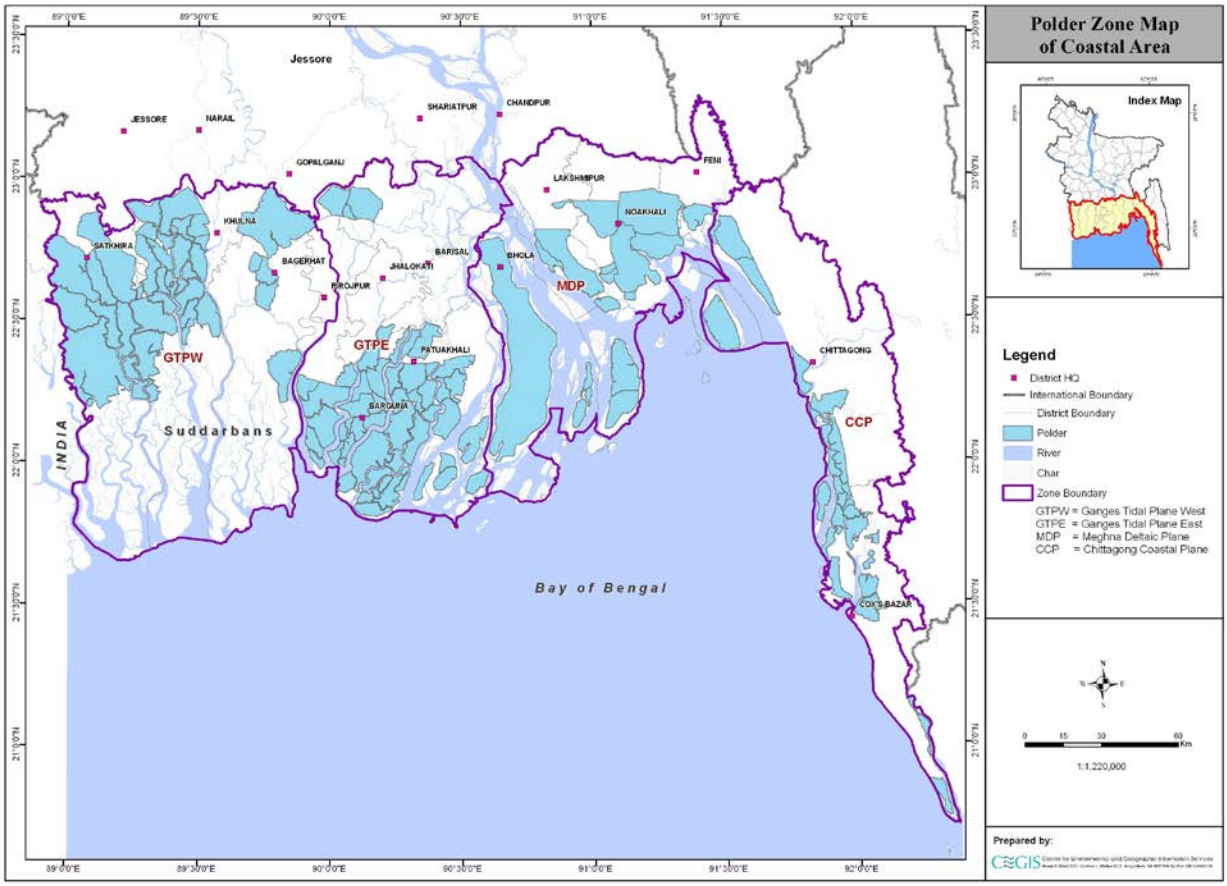


Figure 4-1: Polders in Coastal area of Bangladesh

- **Ganges Tidal Plain West (GTPW)** zone is extended from the Indian border to the centre of the Baleswar and Gorai Rivers. The area is mainly distinguished by the presence of the Sundarbans. It is intersected by distributary rivers derived from the Ganges, mostly via the Gorai River, and is essentially a moribund delta formation; most of the inland rivers now carry little or no water in the dry season. There are 41 polders in this zone.

- **Ganges Tidal Plain East (GTPE)** zone covers from the centre of the Baleswar and Gorai Rivers to the centre of the Tetulia River (the Tetulia River is the westernmost major channel carrying water from the Meghna River). This area comprises polders separated by rivers deriving from the Meghna Estuary, but not carrying any large fractions. 52 polders are located in this zone.

[9] Bangladesh Bureau of Statistics, BBS, 2010

- **Meghna Deltaic Plain (MDP)** zone lies between the middle of the Tetulia River on the west, and on the east the middle of the Feni River plus the Swandip Channel. This is the currently active estuary of the Meghna (carrying water from the Ganges and the Brahmaputra also). Most of the area is characterized by extensive erosion and deposition (accretion) of sediment by river and tidal actions. This zone comprises 18 polders.

- **Chittagong Coastal Plain (CCP)** is located from the middle of the Feni River and Swandip Channel to the Teknaf peninsula and the Myanmar border. This is a narrow coastal plain between the Bay of Bengal and a range of hills. Hydrologically independent of the Meghna estuary, the plain is intersected by a number of small and medium-sized rivers, prone to flash floods that drain those hills. There are 28 polders in this zone. Distribution of the polders in four zones of coastal area is given in Table 4.1.

Table 4-1: Polders in different zones of coastal area

Zone	Districts	Number of polders
Ganges Tidal Plain West (GTPW)	Satkhira, Khulna, Bagerhat	41
Ganges Tidal Plain East (GTPE)	Pirojpur, Jhalokathi, Barisal, Barguna, Patuakhali	52
Meghna Deltaic Plain (MDP)	Bhola, Lakhsmipur, Noakhali, Feni	18
Chittagong Coastal Plain (CCP)	Chittagong, Cox's Bazar	28

4.2 Physical Settings of the Coastal Regions

4.2.1 Climate

94. The climate of Bangladesh is dominated by sub-tropical monsoons characterized by wide seasonal variations in rainfall, moderately warm temperatures, and excessive humidity. Whole Bangladesh is divided into seven climatic zone, of which the coastal areas comprises three climatic zone – (A) South-eastern zone, (F) South-western zone and (G) South Central zone (Figure. 4.2). There are four prominent seasons in a year namely pre-monsoon (March-May), monsoon (June-September), post-monsoon (October-November), and winter (December-February).

95. *Temperature*: In the coast zone of Bangladesh, maximum and minimum temperatures ranges from 30^0C to 36^0C and 11-23^0C respectively (WARPO, 2006). Temperatures are higher in April and May while January is the coldest month of the year.

96. *Rainfall:* In the coastal region of Bangladesh , annual rainfall increases from a little over 1,700 mm in the west to over 3,200 mm at Cox's Bazar in the east. Heavy rainfall is most frequent along the east coast from Feni to Cox's Bazar. Apart from the connectivity instability of the southwest air mass, the sea breeze reinforces the orographic lifting caused by the north south oriented hills of the Chittagong and Chittagong Hill districts. The foothills receive most of the downpours.

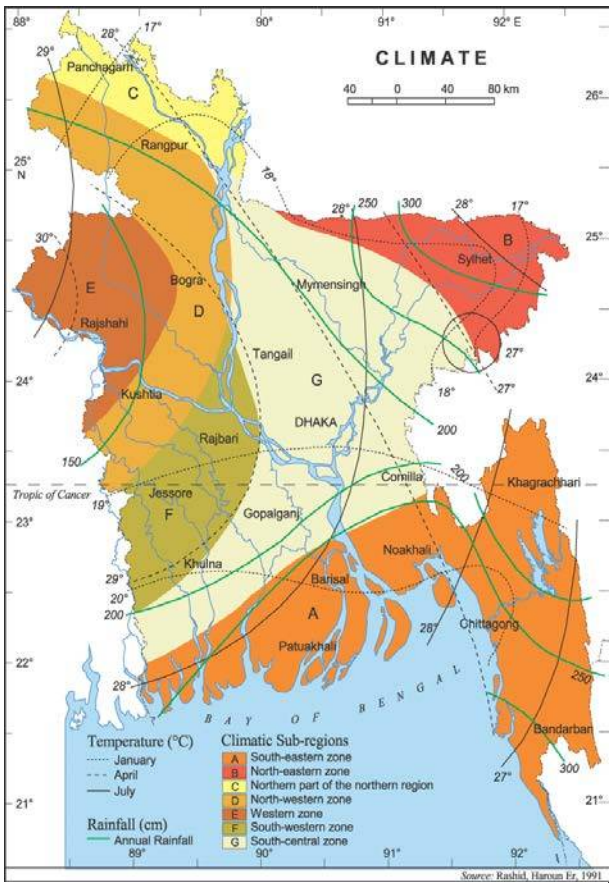


Figure 4-2: Climatic Zones of Bangladesh
(Source: Banglapedia, 2006)

97. *Evaporation and Humidity:* In the coastal zone low values of humidity are found during January-April and peak values during June-October. Evaporation exceeds rainfall only in the months of December and January. In all other months evaporation exceeds rainfall. Higher excess occur in the period May - October, and the lowest in February - April and in November.

98. *Wind:* In the coastal zone wind blows mainly from two directions: NE and SE. The NE winds blow mainly in the winter season and the SE winds during summer. The maximum average wind speed is 80 km/ hr (50m/hr) [10].

4.2.2 Land Use

99. The coastal area of Bangladesh covers different types of land uses ranging from agriculture/fallow lands (63%), settlements (19%), water bodies/ rivers to forest (Figure. 4.3). The GTPW and CCP zones are mostly covered by mangroves and other forests. World's largest mangrove forest – the Sundarbans is located in the southern part of GTPW zone, which is both locally and globally very important for its biodiversity and ecosystem services. The central zones – GTPE and MDP are covered by char lands, rivers and agriculture/ fallow lands.

100. Inside the coastal polders, major land uses are agriculture/ fallow lands, settlements, road and river channels. About 64% and 30% of the total area of 139 polders is being used as agriculture/ fallow lands and settlements respectively. Shrimp firms and salt farms are included in the agriculture/ fallow land use pattern in this estimate. The shrimp farms are mostly located in brackish water areas throughout coastal zone, whereas salt farms are mainly located in the CCP zone.

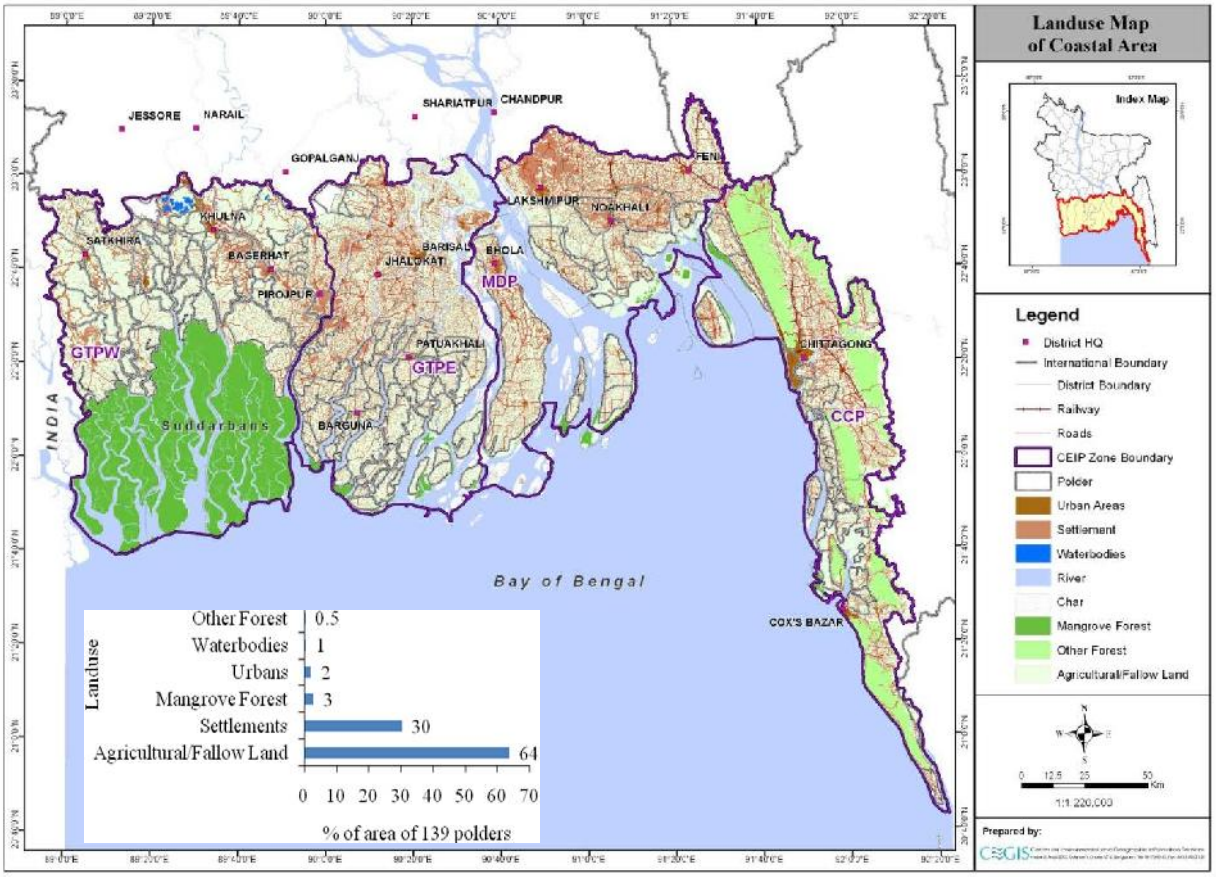


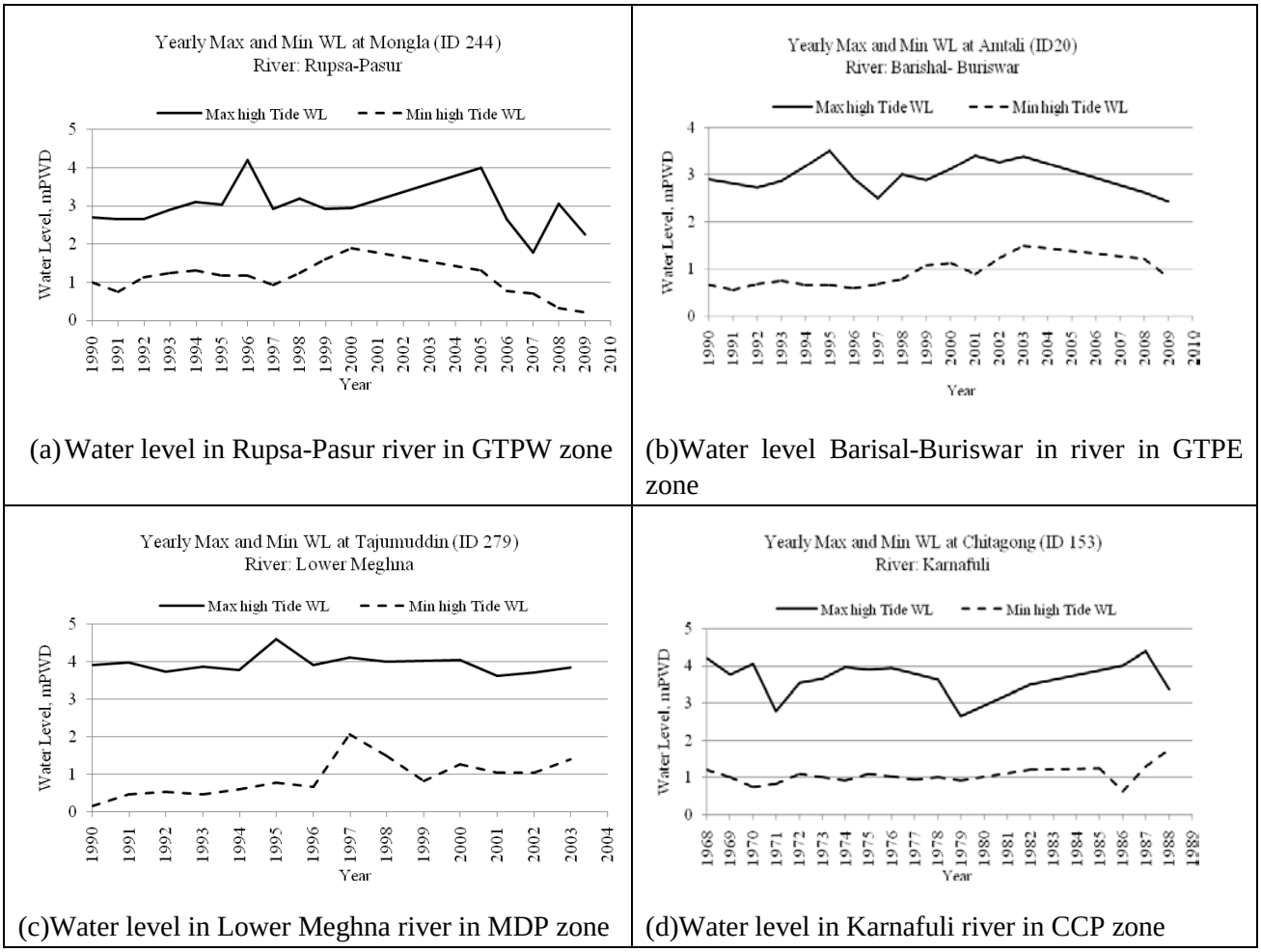
Figure 4-3: Land Use Map of Coastal Area

[10] Bangladesh Coastal Embankment Rehabilitation Project (CERP, 2005)

4.3 State of the Environment

4.3.1 Water Resources

101. Coastal areas are endowed with both fresh and brackish water resources. The fresh waters are available in upstream part of rivers, ponds, wetlands and groundwater. Brackish waters are mainly in the estuarine part of the rivers and tidal cannels/ creeks. Major rivers flowing though the coastal area are Gorai – Madhumati -Baleswar river and Rupsha - Pussur river in the GTPW zone; Buriswar river in GTPE zone; Meghna river in MDP zone; and Karnafuli river and Feni river in CPP zone. Recent records of some water level stations in major rivers of coastal zone show that water level did not vary much over the past decade (Fig. 4.3). There is no available information on water discharge of the rivers in the coastal area.



(a) Water level in Rupsa-Pasur river in GTPW zone

(b) Water level Barisal-Buriswar in river in GTPE zone

(c) Water level in Lower Meghna river in MDP zone

(d) Water level in Karnafuli river in CCP zone

Figure 4-4: Historical water level in major rivers in coastal zone of Bangladesh

102. There are many beels, baors and ponds in the coastal area which are used as freshwater sources for people, fisheries and wildlife. Most of the beels and baors are located in the GTPW and GTPE zone. In addition, shallow groundwater aquifer provides almost 80% of drinking water supply to the coastal communities. Moreover, rainwater is being used in some areas through different rainwater harvesting technologies.

103. During the monsoon, there is abundant fresh water, whereas during the winter, water scarcity becomes prominent. Due to reduced flows in the rivers in winter, both surface water and groundwater systems suffer from saline water intrusion, making the resource unsuitable for agricultural, domestic and industrial purposes. Furthermore, arsenic contamination in groundwater is becoming a severe threat to public health. Therefore, drinking water supply and irrigation for agriculture are important issues that need much attention of the concerned government authorities.

4.3.2 Morphological condition

104. The coastal zone of Bangladesh comprises 'Ganges Tidal Plain' that lies in the west of the Meghna estuary (bounded by the Tetulia River) and 'Chittagong Coastal Plain' that lies in the south and east of the Meghna estuary.

105. The Ganges Tidal Plain (West) is dominated by the Sundarbans forest, which covers the first 60 to 80 km inland from the coastline. Being a mature delta formation, the area has long drainage lines of low gradient. The rivers are sinuous and flow generally south through the plain. In recent decades and particularly since construction of the Farakka Barrage, there is little or no fresh water input from the parent river (the Ganges) during the dry season. Tidal flows extend far inland. Many polders have been constructed, some of them 150 km from the coast. Due to the movement of the tidal wave from west to east along the coast, there is a net flow in the same direction in interconnecting tidal channels between the main river channels. Tidal river channels have tended to silt up and reduce their capacity in response to the reduced tidal prism caused by empoldering land areas. As a result, maximum water levels and inland tidal range are higher than before, such as at Khulna.

106. The Baleswar River forms the boundary between the west and east parts of the Ganges Tidal plain. The eastern part of the plain is characterized by a younger stage of estuary development; the land is intersected by a number of rivers drawing water from the Meghna, or from the Ganges via the Gorai or from Padma via the Arial Khan. There is no substantial forest area, and polders extend about 60 km inland from the coastline. The rivers are generally more active morphologically than in the western part of the plain. Wind waves erode the bank line at water level over the tidal range and currents cause erosion and steepening of the bank under water at the outside of bends, leading to shear failure. This results in migration of the rivers and erosion of polder embankments.

107. The Chittagong Coastal Plain is a narrow strip of land along the eastern side of the Bay of Bengal with relatively short drainage lines between the hills to the east and the coastline. The rivers are steep and flashy. The flood flows are sediment laden and with the reduction in slope from the hills to the coastal plain, the river channels tend to become severely meandering. There are examples of recent meander cut-off in the Bharuakhali and Baghkhali rivers. In case of the Karnaphuli River, extensive river bank revetment and training works have been installed for the port which has prevented further morphological activity in the lower reaches. River flows are regulated by Kaptai Dam except at times of extreme floods.

4.3.3 Sedimentation and Accretion

108. Land erosion and accretion are common natural phenomena in the coastal zone. Major stable accretions were found in the coastal belt of Patuakhali and southern part of Bhola district. The past rate of net accretion in this region was 12 sq. km per year. Erosion at the rate of 3 sq. km and accretion at the rate of 15 sq. km took place in the last 20 years. Islands in this region may grow by silting up of small channels. The past trend of erosion and accretion may continue to follow for the next 25 years[11].

109. Both erosion and accretion in the Meghna estuary region (i.e. northern part of Bhola district, Lakshmipur, Noakhali and Feni coastal belt, Hatiya arid Sandwip area) were found to be prominent. The past rates of erosion and accretion per year were detected as 20 sq. km and 28 sq. km respectively. So, net accretion rate was 8 sq. km per year. This past trend of erosion and accretion may continue in the future but the net accretion may be less. Major threat of erosion in the next 25 years may be in the region of northern part of Bhola, Lakshmipur coastline, north and northeastern parts of Hatiya, north and western parts of Swandip. Slow accretion may take place in the southern part of Hatiya and Noakhali mainland. Erosion and accretion in the Feni coastal belt is expected to be insignificant.

110. Erosion and accretion in the regions of Harinbhanga River to Rabnabad channel and Feni River to Shahapari Island may be insignificant in the next 25 years. Small patches of erosions and accretions may take place here and there.

[11] Integrated Coastal Management Zone Management Program (2001)

4.3.4 River functionalities and estuary processes

111. Dynamic river and estuary processes are, of course, mostly to be seen in the Meghna Deltaic Plain (MDP), rather than in the other three areas. The Brahmaputra and Ganges rivers, via the Jamuna and Padma rivers, bring roughly two billion tons of sediment per year into the system, of which some 70% is fine material, very fine sand and silt. In comparison to this, the sediment from the Meghna River's own catchment is negligible[12] (CERP-II, 2000). Most of the sediment is initially carried through the estuary and deposited in the Bay of Bengal. The shifting and sorting of the sediments is done by coastal and marine processes, like tides, waves and surges, as well as by fluvial ones.

112. Near the head of the Meghna estuary, around Chandpur and upstream, the dominant processes are fluvial, resulting in braiding and the migration of the thalweg (deepest or main channel). Further downstream, tidal and salinity effects begin to have an influence also, but as far south as Ramgati the migration of the thalweg is the most important process. Dramatic thalweg migration in the much smaller estuary of the Feni River is also eroding a polder embankment. When a thalweg approaches a river bank it tends to erode the bank mainly below water level, so that an embankment built close to the bank will be undermined or outflanked by removal of soil below the level of its toe.

113. In the seaward parts of the estuary, tidal processes tend to dominate over fluvial ones. In many parts the tidal flow is bi-directional, but the ebb and flood velocities are unequal (tidal asymmetry, leading to 'tidal pumping' of sediment). In other places, notably north and west of Swandip Island, ebb and flood currents follow different routes (mutually evasive currents). In both cases tidal action moves sediment, often towards inland direction. Under some circumstances sediment can be trapped.

4.3.5 Air water and noise quality

114. Air quality: Air pollution is not much significant concern in the coastal area of Bangladesh. Major emissions are coming from road and river transports and industries (e.g. cement factories, petroleum industries, power plants). Ambient air quality (mainly three parameters - SPM, SOx, NOx) was tested in eight locations in the entire coastal area (4 urban and 4 rural) (Table 5.1). It is observed that the present air quality parameters are within standard limits in most areas, except high SPM in Khulna city, Chittagong, Cox'sbazar and Noakhali town mainly due to high traffic loads.

Table 4-2 Air Quality in Coastal Area[13]

Sample Location	**Type of Location**	**Date**	**Air Quality Parameters**		
			SPM ($\mu g/m^3$)	SOx ($\mu g/m^3$)	NOx ($\mu g/m^3$)
Shibbari moor, Khulna City, Khulna	Urban	01/05/12	410	27	46
In front of upzila polli unnyon board office, Thana moor, Sharankhola, Bagerhat	Rural	03/05/12	140	11	20
Bus stand moor, Pirojpur town, Pirojpur	Urban	02/05/12	180	10	18
In front of Upazila office, Mathbaria, Pirojpur	Rural	02/05/12	148	5.2	15
Foy's Lake Moore, Khulshi, Chittagong	Urban	20/05/12	314	5.4	14.2
Chokoria Bus Stand, Cox's Bazar	Rural	23/05/12	290	ND	10.2
Court road, Maijdi, Noakhali	Urban	21/05/12	280	4	12.5
In front of Haji Bari, Laksmi Narayanpur village, Noakhali	Rural	21/05/12	45	ND	ND
ECR standard for Residential and Rural area			200	80	80

115. Surface water and groundwater Quality: Domestic sewerage, industrial wastewater, oil spill from water transports are the major source of water pollution in the coastal area. Surface water quality of some major rivers and ponds were tested in coastal region (Table 4.3), which showed that most of the water quality parameters were within standard limit. pH and electrical conductivity (EC) values indicates that both river and pond water were saline. Also high concentration of coliform was found in pond waters. In addition,

[12] Bangladesh Coastal Embankment Rehabilitation Project (CERP- II, 2000)

[13] *Lab test by DoE, Khulna and Chittagong, May 2012*

ND: Not Detected

groundwater quality was tested through collecting tube-well water samples from eight different locations in coastal areas (Table 4.4). It was observed that most of the water quality parameters are within threshold limit with exceptions in few locations (e.g. high Chloride in Khulna city, high iron content in Noakhali town and high concentration of Arsenic inNoakhali area) (Table 4.4). In general, higher Chloride content, i.e. salinity was found in all tube-well.

Table 4-3: Surface Water Quality In Different Rivers In Coastal Area

Sample Location Date	Date	Surface Water Quality Parameters									
		Temp. (°C)	pH	EC (µS/cm)	DO (mg/L)	BOD (mg/L)	COD (mg/L)	TDS (mg/L)	SS (mg/L)	Coli colonies(No/100ml	N-nitrate (mg/l)
Baleshore river (up), Chalna Namajpur, Pirojpur	01/05/12	29.2	6.86	0.49	7.8	0.4	25	1463	45	350	2
Baleshore river (down), Mathbaria, Pirojpur	01/05/12	29.1	6.86	1.12	7.2	0.4	20	1163	45	375	2
Gunakhali river near Raenda bazar, Sharankhola, Bagerhat	02/05/12	31.5	6.86	2.33	7.8	0.4	20	353	60	250	2
Rupsha river ghat Side point, Khulna	03/05/12	29.2	7.71	3.34	7.2	0.8	28	817	70	520	2
Surface water sample of Karnafully river water 15 No ghat, Potenga, Chittagong	20/05/12	32	7.84	2.81	7.3	2.4	351	1268	1079	190	1.3
Surface water sample of Maijdi DC office Dighi, Noakhali	21/05/12	31.6	7.4	2.36	7.9	2.6	8	950	67	1150	0.5
Surface water sample of Haji Bari Pond, Lakki Narayonpur, Sadar Noakhali	21/05/12	30	7.21	2.72	8.6	8.4	12	1400	234	1420	0.8
Surface water sample of Matamuhuri river Chokoria Cox's Bazar, Cox's Bazar	23/05/12	31	6.94	2.44	8.2	1.1	3	1540	75	210	0.2
Standard for inland surface water for fisheries as per ECR'97		NA	6.5 – 8.5	NA	≥5	≤6	NA	NA	NA	NA	NA

Note: ND = Not Detected; NA= Not Available
Source: Lab test by DoE, Khulna and Chittagong, May 2012

Table 4-4: Ground Water Quality In Different Rivers In Coastal Area

Sample Location	Date	Ground Water Quality Parameters					
		Temp	pH	Chloride (mg/l)	Iron (Fe) (mg/l)	SS (mg/l)	As (mg/l)
Tube well water of Danishafa UP office, Mothbaria, Pirojpur	01/05/12	25.4	7.56	355	0.78	5	0
Tube well water of Pirojpur upazila health complex, Pirojpur town, Pirojpur	02/05/12	25.3	7.25	421	0.8	4	0
Tube well water of upazila primary school, Sharankhola, Bagerhat	02/05/12	25.2	7.45	532	0.88	4	0

Sample Location	Date	Ground Water Quality Parameters					
		Temp	pH	Chloride (mg/l)	Iron (Fe) (mg/l)	SS (mg/l)	As (mg/l)
Tube well water of Divisional Commissioner office, Khulna	03/05/12	25.6	7.57	667	0.45	5	0
Deep T/W sample of Akbarsha mosque, Khulshi, Chittagong	20/05/12	28.0	7.2	66	0.14	1	0
Deep T/W sample of Mojaffor Haji Bari, Laksmi Narayanpur, Noakhali Sadar, Noakhali	21/05/12	26.0	8.3	224	0.76	3	0.5
Deep T/W sample of Kiron Hotel, Maijdi Court, Noakhali	21/05/12	28.7	7.7	388	2.86	2	0.6
Deep T/W sample of Mr. Zakir Hossain home, Kakara, Chokoria, Cox,s Bazar	23/05/12	29.0	6.7	182	0.78	3	0.03
Drinking water quality standard as per ECR'97			6.5 – 8.5	150 –600	0.3 – 1.0	10	0.05

Source: Lab test by DoE, Khulna and Chittagong, May 2012

116. Noise quality: Noise quality was tested for day and night in eight locations (both urban and rural) of 6 coastal districts (Table 4.5). Noise quality was found above standard level both in day and night time in some urban and rural areas.

Table 4-5: Noise Quality In Different Rivers In Coastal Area

Location	Type of Area	Date	Noise level (dBA)		Standard as per ECR'97 (dBA)	
			Day	Night	Day	Night
Khulna City, Khulna	Mixed	04/05/12	71	53	60	50
Sharankhola, Bagerhat	Residential	02/05/12	58	39	50	40
Pirojpur town, Pirojpur	Mixed	3/05/12	58	44	60	50
Mothbaria, Pirojpur	Residential	01/05/12	55	41	50	40
Chittagong city, Chittagong	Mixed	20/05/12	58	50	60	50
Noakhali town, Noakhali	Mixed	21/05/12	55	45	60	50
Laksmi Narayanpur,Noakhali	Residential	21/05/12	49	50	50	40
Chokaria, Cox's Bazar	Residential	01/05/12	57	44	50	40

Source: Lab test by DoE, Khulna and Chittagong, May 2012

4.3.6 Soil and Agriculture

117. The coastal area of Bangladesh is included mainly under Agro-ecological region 13: Ganges Tidal Floodplain, 18: Young

118. Meghna Estuarine Floodplain and 23: Chittagong Coastal Plain. It represents part of extensive area of tidal floodplain land with smooth relief crossed by innumerable tidal rivers and creeks. River banks generally stand higher above the adjoining basins. The area is mainly shallowly flooded at high tide, either throughout the year or only in the monsoon, except in the extensive areas where tidal flooding is prevented by embankment. Within embankments, there is seasonal flooding with accumulated rain water.

119. In the coastal area, several soil types occur, varying in texture from sandy loams to heavy cracking clays. Most of the soils of the coastal area are saline and non-calcareous, except for some soils of the Old Ganges and Meghna floodplain areas. Most of the soils of the coastal zone are moderately to strongly alkaline.

120. The coastal region covers about 3.6 million acres of Net Cultivated Area (NCA) with average cropping intensity of 175%, where mostly local and hybrid rice crops are grown[14]. The 139 polders cover a gross area of about 1.12 million ha, of which about 64% are available for crop cultivation. Agriculture practices in the coastal zone are mainly rain-fed cropping and irrigated cropping system (Figure 4. 5).

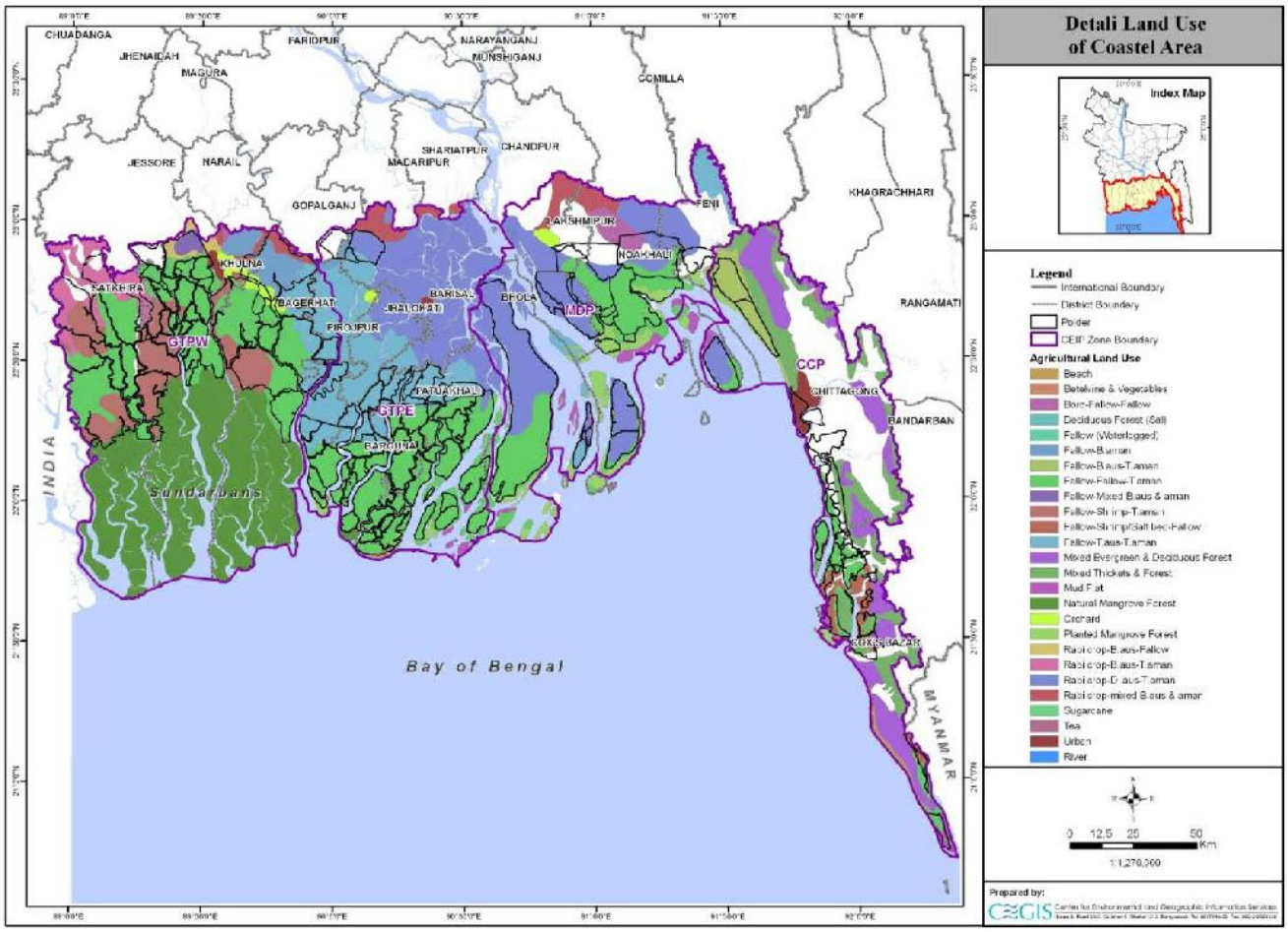


Figure 4-5: Agricultural Landuse Pattern in Coastal Area

121. On highlands under rain-fed condition, the major cropping sequences are local/HYV broadcast Aus followed by local/HYV transplanted Aman, and local broadcast Aus followed by a wide range of Rabi crops depending on the residual soil moisture

122. A wide variety of Kharif vegetables are also grown in place of Aus in areas having suitable soil characteristics and serviced by highways and arterial roads. Locally, jute is the main cash crop, replacing broadcast Aus in the cropping pattern. Kharif vegetables are also grown replacing broadcast Aus or jute. Occasionally, a short duration Rabi crop (wheat/vegetables/pulses) is cultivated between the main cropping sequences as a third crop, primarily depending on residual soil moisture in the early Rabi season.

123. On medium highland, intermittently flooded up to 90 cm, local / HYV broadcast Aus is followed by local / HYV transplanted Aman as the major cropping sequence. Rabi crops like wheat, pulses, oilseeds, vegetables, spices and minor cereals are also cultivated either as a third crop or as a second crop after transplanted Aman.

124. On medium lowland early broadcast Aus or late transplanted Aman is grown to avoid damage from flooding, which starts in June and peaks in mid-August. Jute, followed by wheat or potato, is also grown on this land type.

[14] Bangladesh Bureau of Statistics, 2009

125. On the edge of basins, broadcast Aus is grown followed occasionally by pulses, mainly Khesari (Lathyrus), a low value legume, with mustard as Rabi crop. Minor lowland, is transplanted with HYV Boro crop, if not sown with broadcast Aman in late February/March as a single crop. In the double cropped areas, Rabi crops e.g. wheat, potato and some vegetables are grown following broadcast Aman or Aus. Because of vulnerability to flood damage, no other Kharif crops are grown.

126. Irrigation water for crop production in the dry season is very scarce except a small area managed under irrigation schemes. About 13% of the net sown area (or 7.80% of the total cropped area) is irrigated by a mixture of mechanical (STW and LLP) and indigenous (HTW, Don, Swing Basket, etc) irrigation means. Deep tube-wells are almost absent. Irrigation by STW is generally concentrated in the F_1 area because of the need to site the equipment on higher ground to avoid submergence by flood. STW and LLP are used to irrigate high, medium high and medium lowlands. The indigenous methods are normally practiced to irrigate crops situated near the source of surface water. HYV Boro is the major recipient of irrigation and is normally preceded by rain-fed transplanted Aman. HYV potatoes, wheat and a portion of the Rabi vegetable areas are also irrigated. Supplementary irrigation for wetland crops is practiced and transplanted Aus receive sometimes one or two irrigation during the land preparation stage. In years with insufficient rainfall, transplanted Aman is given supplementary irrigation particularly during the flowering stage in October.

127. Agricultural practices are based on soil and land type, availability of irrigation, demand of crop products, etc. The existing cropping pattern is predominantly rice based. Rice covers a major portion of the total cropped area (approximately 75%). The remaining area includes other crops in both Kharif and Rabi seasons. Rabi crops are wheat, winter vegetables, bean, cowpea, pulses, oilseeds, potato, sweet potato, chili, cowpea, millet, water melon, ground nut, etc.

128. Overall, the following are the <u>important issues in 'agriculture' sector related to CEIP</u> :

- Soil salinity is the most dominant limiting factor for agriculture practices in the region, especially during the dry season.
- Scarcity of quality irrigation water during dry season limits cultivation of boro rice and rabi (winter) crops, and aus cultivation during kharif-1 (March-July) season.
- Variability of rainfall, uncertain dates of onset and recession of seasonal floods and risk of drought restrict cultivation of aus and aman rice.
- Perennial water-logging due to inadequate drainage and faulty operation of sluice gate facilities restricts potential land use within the polder areas.
- Difficult communication and remote marketing facilities also retard agricultural development of the region.

4.3.7 Fisheries

129. The coastal fishery mainly consists of two types of fishery, such as capture and culture fishery in the fresh to brackish water environment. Capture fisheries are categorized into three different fish habitats namely Rivers and canals fishery, Marine Artisanal fishery and Post Larvae (PL) fishery. Similarly Pond/ditches and Shrimp Ghers are the habitat category of culture fishery. The fish habitat are presented in Figure 4.6

River/ canals

Ponds/Ditches

Gher

Figure 4-6: Coastal fish habitats

130. The major species of capture (both brackish and fresh) fishery include Hilsha (*Tenualosa ilisha)*, Bhetki (*Lates calcarifer)*,Poa (*Pama pama)*,Parsia (*Liza parsia)*,Tapasi (*Polynemous paradesious*),

Tulardanti (*Sillago domina*), Phasa (*Setipinna phasa*), Bagda (*Penaeus monodon) etc.* The composition of coastal capture fisheries are presented in Appendix - 2. In 2008-2009, the coastal zones capture fisheries production of rivers, beels, Baors, floodplains and Sundarbans is about 340,128 metric ton.

131. Two forms of aquaculture are practicing in the coastal zone such as fish culture (mainly fresh water species) and shrimp. The pond fish culture is found more in the polders of Ganges Tidal Plain West and East, Meghna Deltaic Plain (MDP). The pond/ditches are mainly cultured with white fish and the Ghers are cultured with shrimp as mono culture and shrimp along with white fish/prawn as mixed culture. Most of the ponds having the average size of 2000 sq. ft. are polyculture ponds. The three most commonly used fish species in pond aquaculture are major carps Rui (*labeo-rohita*), Catla (*Catla catla*) and Kalibaus (*Labeo calbusa*). Other culture species include common carp (*Cyprinus carpio*), Grass carp (*Ctenopharyngodon idellus*), Silver carp (*Hypophthalmichthys molitrix*) and two Tilapia species (*Oreocromis mossambicus* and *Oreocromis niloticus*), Pangas (*Pangasius sutchi)* etc. In 2008-09, average yields from different ponds was 2853 kg/ha in the coastal zone while country average is 3141 kg/ha. However, average yields were 3102 kg/ha for the culture ponds, 1584 kg/ha for the culturable ones and only 910 kg/ha for the derelict ponds.[15]

132. In the CEIP area, the total cultivable land area is about 931,300 ha of which shrimp farm covers 89,200 ha. Most of the shrimp farms are found in the polder area of Khulna, Bagerhat, Satkhira, and Cox's Bazar districts. The Gher culture fishery includes Bagda (*Penaeus monodon, P. indicus),* Golda *(Macrobrachium rosenbergii),*Baila *(Glossogobius giuris),*Golshatengra *(Mystus sp)* etc. In 2008-2009, the fisheries production of Gher (Shrimp/Prawn, fish) in the coastal area was about 668 kg/ha. Over the last 30 years the significance of the shrimp has grown rapidly in the coastal zone. The shrimp farms play a major role in employment, and foreign exchange earning in Bangladesh. According to DoF statistics, the shrimp production in the coastal zone amounted to 99.89% of the country's total in 2008-2009. It is the second biggest foreign exchange earner for the country.

Hilsha (*Tenualosa ilisha*)

Bagda shrimp (*Penaeus sp*)

Baila*(Glossogobius giuris)*

Figure 4-7: Important fish species in coastal region

133. Although the coastal area is rich in capture fisheries especially brackish water fisheries, presently the culture fisheries like shrimp culture practices is increasing extensively in southwestern and south eastern zone. Therefore, the mono fish culture will be increased which will influence the increasing of specific fish species. On the other hand, salinity intrusion due to sea level rise could reduce habitat for fresh water fish in the coastal area. Consequently, production of freshwater fisheries may be hampered as the species of fresh water carp, catfish, perch etc. are highly susceptible to moderate level of salinity.

134. The major problems and issues of fisheries sector in the coastal area are as follows:

- Morphological changes in rivers, poor fisheries management and changes of aquatic ecological conditions;
- Decreasing of fish habitat and depth due to siltation;
- Increasing salinity in surface water;
- Losing floodplain fisheries due to extensive shrimp culture practices;
- Obstruction of feeding and spawning migration due to inadequate migratory routes between rivers and different internal water bodies;
- Poor fish marketing system and post harvest facilities due to poor communication and infrastructure.

[15] Department of Fisheries, 2010

4.3.8 Ecosystems and Biodiversity

135. ***Bio-ecological zone:*** The coastal zone of Bangladesh falls in ten different bio-ecological zones namely the Ganges floodplain and Major rivers, Coastal marine water, Meghna floodplain, Sundarbans, Chakaria Sundarban, Coastal plains, Offshore islands, Meghna estuarine floodplain.

136. ***Ecosystems:*** The coastal area is enriched by different type of fresh to brackish water ecosystems due to its ecological and physical settings. The ecosystems of the region can also be classified as per habitat type, i.e. marine, brackish water, freshwater, mangrove, Sundarbans, floodplain, island, peninsula, and terrestrial ecosystem (roadside and homestead). Moreover, shrimp farming pond (Gher) ecosystem are found in this area.

137. ***Protected Areas:*** There are different types of ecosystem management approach applied to protect vulnerable ecosystems in the coastal region of Bangladesh, such as declaring Ecologically Critical Area (ECA), Ramsar site, National Park, Wildlife Sanctuaries, Eco-park, Game Reserve, World Heritage Site, Marine Reserve and Fish Sanctuaries. The protected areas in the coastal zone are presented in Appendix 3. Some of the coastal polders fall within these protected areas, mainly in the Sundarban region (Satkhira, Khulna and Bagerhat district). Relevant rules and regulations need to be followed while undertaking any development activities in these protected areas.

138. ***Common flora and fauna:*** The coastal zone has a good terrestrial and aquatic environment that provides habitat for a large number of flora and fauna.Hargoza (*Acanthus illicifolius*), Narikel (*Cocos nucifera*), Khejur (*Phoenix sylvestris*), and Bhadi (*Lennea coromandelica*) are the native dominant flora. Jackal (*Canis aureus*), Grey mask shrew (*Suncus murinus*) and small Indian civet (*Viverricula indica*) are the dominant native mammals and randomly found in the area where shrimp farming is limited. Saurs crane (*Grus antigone*), Black-winged stilt (*Himantopus himantopus*), Little grebe (*Tachybaptus ruficollis*), Red-wattled lapwing (*Vanellus indicus*) were once commonly seen in this region but rarely found at today. Ring lizard (*Varanus salva*), Banded sea snake (*Hydrophic fasciatus*), Estuarine sea snake (*Hydrophic obscura*), etc are the common reptile in this region but rarely found in the area of intensive shrimp farming practices. The common flora and fauna habituating in this region are listed in Appendix 4.

4.3.9 Mangrove forest

139. The southwestern part of coastal region houses world's largest mangrove forest- the Sundarbans. The mangroves forests are transitional zones between fresh and marine waters, and are rich in marine and terrestrial flora and fauna. Also, the mangrove forests serve as a natural fence against cyclonic storms and tidal surges, stabilize coastlines, enhance land accretion, and enrich soil near the aquatic environment. The Sundarbans Reserve Forest occupies an area of 601,700 hectares of which 406,900 ha forests, 187,400 ha water (rivers, rivulets, ponds, and canals), and 30,100 ha form wildlife sanctuaries, and 4200 hectares are sand bars.

140. The mangrove forest is very rich in biodiversity and supports 334 species of plants, as many as 77 insects of different orders, 7 crabs, 1 lobster, 23 shrimp/prawns, 400 fish, 8 amphibians, 35 reptiles, 270 birds, and 42 species of mammals. There are about 13 and 23 species of orchids and medicinal plants respectively found in the Sundarbans.

141. The Sundarbans was declared a World Heritage Site in 1997 by UNESCO. It is known as the single largest stretch of productive mangrove forest in the world, and is inhabited by one of the most elegant creatures of nature, the Royal Bengal Tiger (*Panthera tigris*), and estuarine crocodiles (*Crocodylus porosus*) occur extensively in the rivers. The Sundarbans is also home to thousands of spotted deer (*Axis axis*). There are large numbers of threatened wildlife species including Python, King Cobra, Clawless Otter, etc

142. Among the commercially important plant species in Sundarbans, the two dominant ones are the Sundari (*Heritiera fomes*) and Gewa (*Excoecariaag allocha*). Among the trees, Gewa and Goran (*Ceriops roxburghiana*) are being used in newsprint mills for paper production, as well as for fuel-wood. Sundari and Keora (*Sonneratia apetala*) are used as timber woods. The most important non-wood forest product is Golpata (*Nypa fruiticans*). Leaves from this plant are widely used for thatching of roofs of houses and boat and also for fencing the houses of millions of families around the coastal districts. According to Forest

Department, 2010, the production rate of timber, fuel wood and thatching materials (Golpata) was about 3567 m^3, 120 tonnes, 26653 tonnes per year respectively during 2001-02 to 2009-10 .

143. The forest resources and biodiversity of Sundarban are vulnerable to natural hazards like cyclone and storm surges as well as the threat of over exploitation. The cyclone Sidr (in 2007) caused immense loss of biodiversity of Sundarban and its adjacent areas. Sea level rise due to climate change is another threat to biodiversity of Sundarban. It is predicted that the Sundari in the mangrove forests are threatened due to increased salinity. Moreover, municipal wastewaters**,** industrial pollution, oil pollution, ship breaking etc. are harmful to coastal and marine biodiversity especially in Chittagong and Khulna region.

144. Sundarbans the largest Mangrove forest of South Asia is in close proximity of the 6 districts of 17 polders. Bagerhat, Sathkhira and Khulna are within the impact zone of Sundarbans (10 km buffer area outside the Sundarbans). Rehabilitation and reconstruction of polders may have indirect impact on the water flow quantity and pattern within the channels of Sundarbans.

4.3.10 Natural Hazards and Disasters

History of Cyclonic Storm

145. Cyclonic storms are an important feature of the Bangladesh climate and have been inflicting suffering to people and enormous damage to structures. During the last 125 year, cyclones hit the coastal belt: 14 occurred during the last 25 years. Two different types of cyclones form in the bay – (i) tropical cyclone, which forms during the pre- and post-monsoon seasons, and (ii) monsoonal depression, which develops during the monsoon season.

146. Cyclones generally cause damage in three different ways: (a) storm surges (b) flooding due to excessive rainfall and (c) wind blowing away houses and ships. About 90 per cent of cyclone casualties are caused by storm surges generated by cyclones. Also, there is a fourth way that can cause damage, i.e. extreme winds can create wind waves which are superimposed on the surge. These waves damage the embankments and run up the embankment slope. If the volume of wave overtopping is excessive, the water is carried over and erodes the country side slope of the embankment. This is very important in embankments that face the sea or wide estuaries which allow the waves to build up strength because of the long "fetch". For example, in Baleswar (polder 35/1, Figure 4.8), the slope was reduced to 1:5, slope roughness elements were added, but an additional 1.5 m still had to be added to the crest level to keep the wave overtopping volume within limits.

Figure 4-8 Damaged Coastal Polder 35/1 near Rayenda along Baleswar due to Sidr

147. Storm winds blow at speeds of up to 240 km per hour cause widespread damage. The high number of casualties is due to the fact that cyclones are always associated with storm surges. Storm surge height in excess of 9m is not uncommon in this region. According to WARPO 2005, the 1876 cyclone had a surge height of 13.6 m and in 1970 the height was 9.11 m. In fact, the 1970 Cyclone is the deadliest cyclone that had hit Bangladesh coastline. With a wind-speed of about 224 km per hour and associated storm surge of 6.1 to 9.11 meters, it was responsible for death of about 300,000 people. In 1991 cyclone (wind speed: 225 per hour , storm surge: 6.0-7.6 Meters), total casualty was 138,882.

148. The cyclone Sidr-2007 (wind speed: 240 per hour , surge height: 4.5 - 6 Meters (15-20 feet)) affected 12 coastal districts -Barisal Patuakhali, Barguna, Pirojpur, Jhalokathi, Bhola, Bagerhat, Khulna, Satkhira, Shariatpur, Chittagong and Cox's Bazar and their offshore islands and chars received the major destructions by the Sidr. Out of 12 severely affected districts, these Bagerhat, Barguna, Pirojpur and Patuakhali were the worst affected. It was observed that 3,363 people died and 55,282 were injured. Approximately 5,64,967 houses were totally destroyed and 9, 57,110 houses were partly damaged. It is also reported that 7,43,321 acres (300812 ha) of crop areas were fully and 17, 30,316 acres (700235 ha) area partly damaged by the Sidr'2007 .[16]

149. The coastal area has faced another devastating cyclonic storm surges called 'Aila'. Cyclone Aila hit 14 districts on the south-west coast of Bangladesh on 25th May 2009. About 2.3 million people were affected by Aila and many of them were stranded in flooded villages as they had no alternative to save themselves. The Cyclone Aila furiously hit the Satkhira and Khulna Districts of Bangladesh. The Aila caused massive damage to coastal polders and embankments and submerged to the villages. A study conducted by Unnayan Onneshan, in 2009 revealed that among the affected districts, Satkhira received the highest amount of impacts in its infrastructures. 734 educational institutions including the religious institutions, 329.25 km roads, 41 bridges or culverts, 292.42 km embankment and 26028 ha shrimp farm (gher) were fully or partially damaged. The study also revealed that 734 institutions were damaged fully or partially. The adverse impacts of Aila were observed in 7 upazilas and 48 unions of Satkhira District. However, Shyamnagar and Ashasuni are the most affected upazila as reported by the local source and available data. More than fifty thousand people were adversely affected by Aila flooding. On the other hand, total damaged cropland was about 1250 ha. Moreover, 59 people died and 1509 were injured during Aila.

River floods

150. Parts of the coastal zone are occasionally subject to river floods which cause major hardship, loss and damage. In the coastal area, extreme floods occurred in 1974, 1980, 1984, 1987, 1988, 1998 and 2000. Near the Meghna estuary these are a natural consequence due to the presence of two very large incoming international rivers, the Brahmaputra and the Ganges, as well as local catchments. Elsewhere, especially in the CCP, they are generated by the prevalent high rainfalls, especially those associated with cyclones. In both cases the flooding is exacerbated by the generally low gradients of land and rivers in the plains. It is reported that extreme flood occurred in Satkhira in 2000. The duration of flooding water was three months. Flooding event caused immense damage to crops and shrimp gher of the Satkhira district. According local people, such type of flood did not occur in the last 60 years. The Kaligonj road was submerged up to 10 feet due to flooding. On the other hand, flood in 1988 and 1998 affected the roads, houses, market places, educational institutes, forest resources, fish pond and crops of different upazila of Cox's Bazar extensively. Flooding water flow over the homestead, roads, and polders more than 5 feet and stayed for few months.

Water Logging

151. Many parts of the coastal area of Bangladesh is facing water logging problem, especially in southwestern region (Khulna, Satkhira, Jessore districts) and Noakhali region (Figure. 4.9). Water logging is created due to natural process of sedimentation in the river and drainage channels as well as improper maintenance of regulators and drainage channels in the coastal polders. Sedimentation in the peripheral rivers and the subsequent loss of tidal range has made it impossible for some polders to be drained as was done previously though the drainage regulators. Also embankment of some polders was breached by the tidal surge during cyclone 'Sidr' and 'Aila' and low lying lands inside coastal polders are inundated. About 30% of all polders are now experiencing water logging in the coastal area. Recent remote sensing images show that water logging is occurring mainly in southwestern region

Figure 4-9: Water logging in Polder 10-12, Koyra and Paikgacha, Khulna

[16] Disaster Management Bureau, 2008

(Bagerhat, Khulna and Satkhira) of coastal zone (Figure 4.10). Water logging in the coastal polders affected almost all livelihood activities (agriculture, fisheries), and road infrastructures.

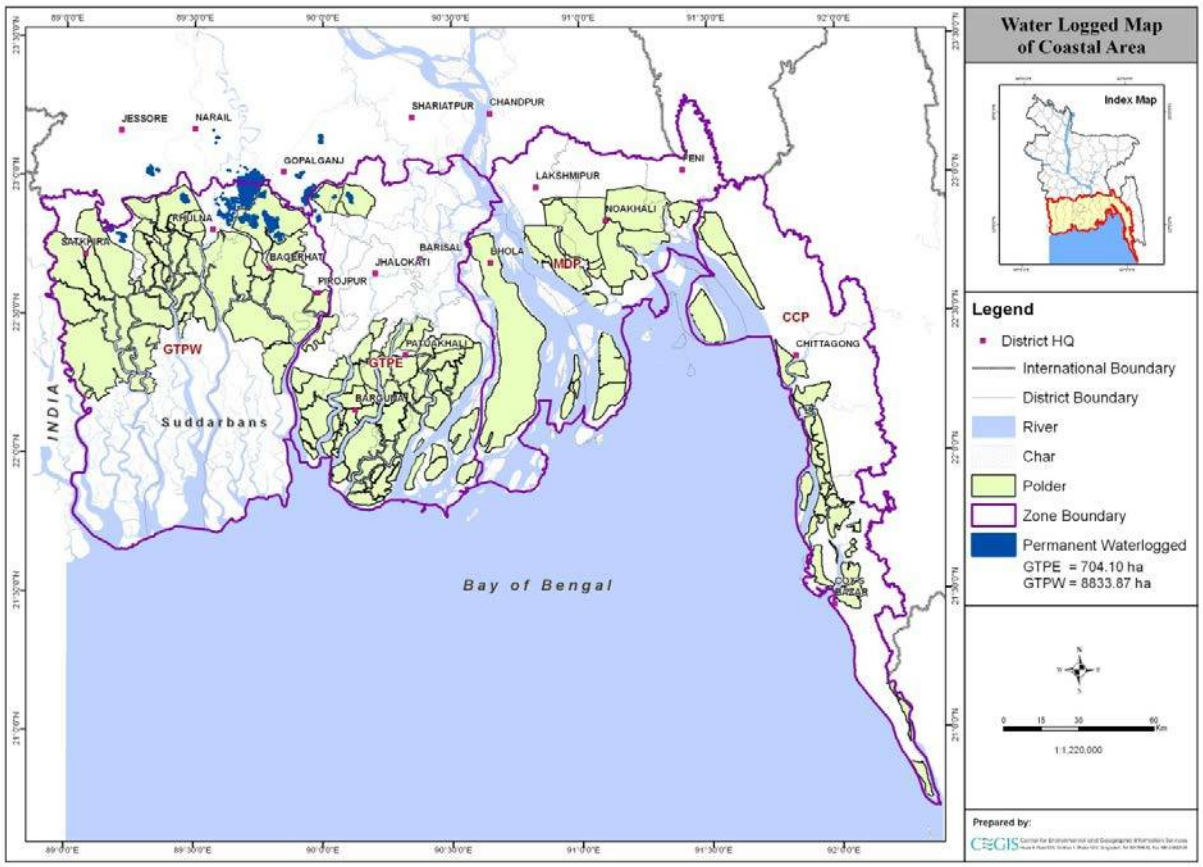


Figure 4-10: Water logging affected areas in coastal zone
(Source: CEGIS, 2011)

Salinity

152. **Soil salinity:** Saline or salt affected soils are common in coastal area of Bangladesh. Soil Research Development Institute (SRDI) in 2010 states that out of about 1.69 million ha of coastal land about 1.06 ha are affected by soil salinity of various degrees. Most of the lands within the Khulna and Barisal division are affected by salinity. The critical salinity level for agriculture is 1 to 5 ppt, for Sundari growth it is in the range of 10 to 15 ppt. Optimum shrimp production is between 10 and 20 ppt. The soil salinity in the coastal area is shown in Figure 4.11. Figure shows the total coastal area affected by low, moderate and high salinity level. The soil of Satkhira, Khulna, Patuakhali (Char land), Bhola (southward) and Chittagong (Swandip) districts are severely affected with strong salinity. North part of Khulna, Bagerhat, Barguna, Pirojpur, Noakhali and Cox's Bazar are affected by moderately to strong salinity.

153. **Surface Water Salinity:** Saline water intrusion in coastal area is highly seasonal in Bangladesh. Salinity and its seasonal variation are dominant factor for coastal ecosystem, fisheries and agriculture. Therefore, any changes on present spatial and temporal variation of salinity would affect the biophysical system of coastal area. During dry season (December to March) deep landward intrusion occurs through various inlets in the western part of coastal zone and through Meghna Estuary. Except Tetulia, Meghna, Kakdon, Subidkhali, Lebukhali, Laukathi, Kukua, Gopaldi, Kajal, Tajumuddin canal under Noakhali, Bhola, Patuakhali, Barisal, Jhalokathi districts almost all the rivers remain highly saline in dry season[17]. Almost all the rivers of Jessore district remain saline. Maximum salinity variation in dry season is shown in Figure 4.12. In dry season, 5ppt isohaline intrude more than 90 km landward at the western part of the coastal area in the Sundarbans through Jamuna-Malancha-Raimangal river. Freshwater flow decreases in the Pasur-Sibsa river system during dry season, the saline front moves upward by 30-40 km. In the Baleswar-Bishkhali river

[17] Soil Research Development Institute, 2010

systems, in the dry season 5ppt saline front moves landward by 20-25km from the coastline. In the middle part of coastal zone along the Meghna estuary, landward salinity intrusion is low because of huge freshwater flow coming through the Meghna river system.

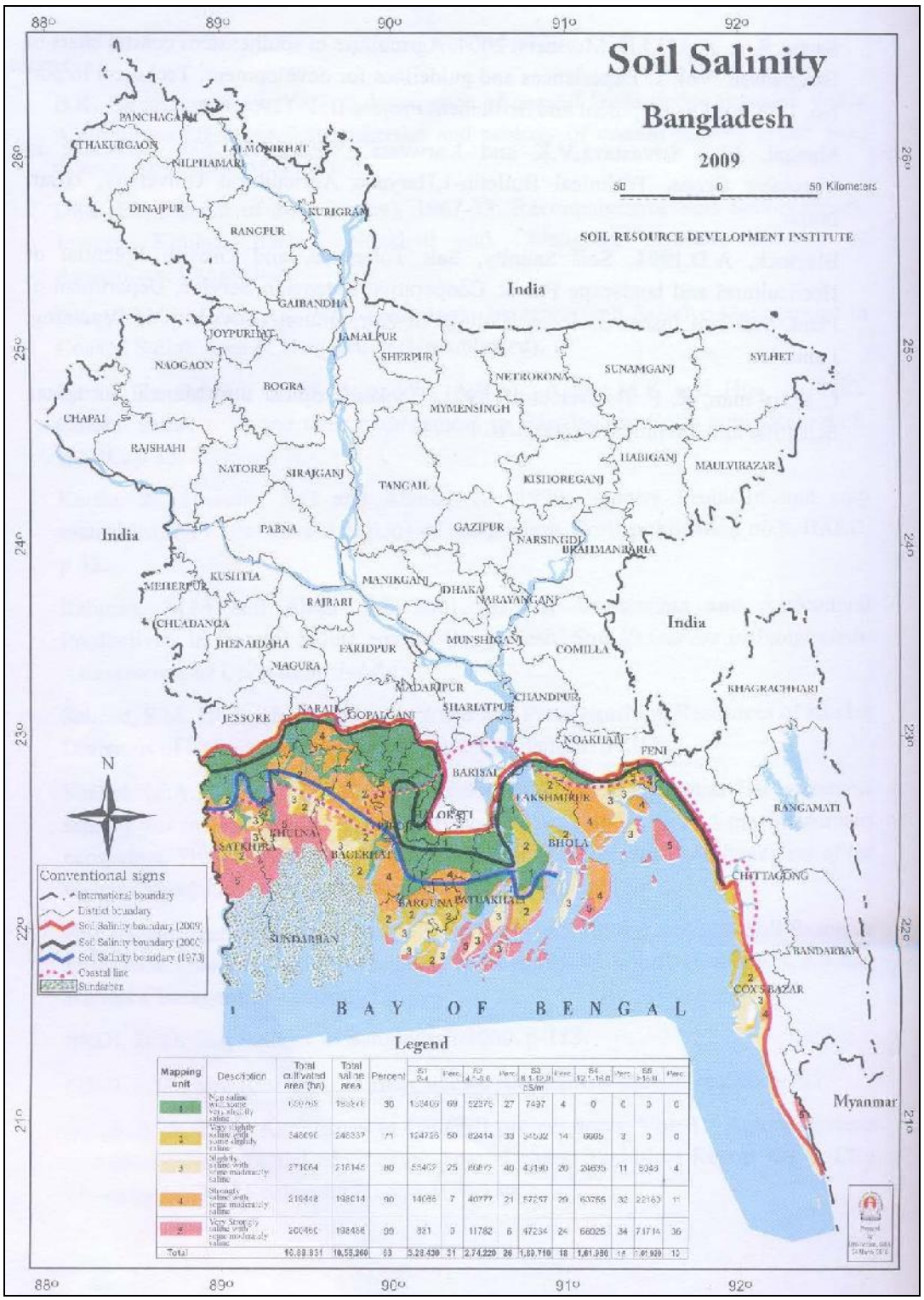


Figure 4-11: Soil salinity (dS/m) in coastal area of Bangladesh in 2009
(Source: SRDI, 2010)

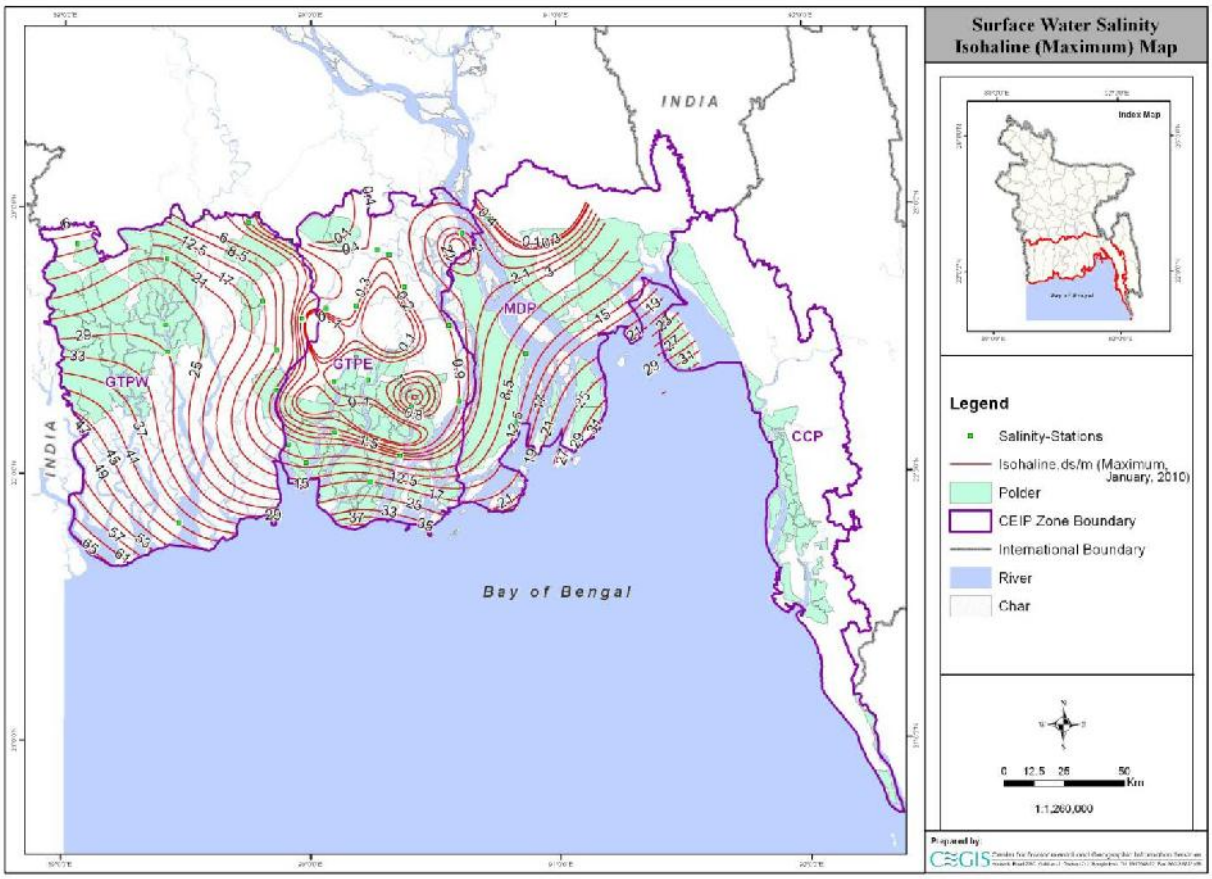


Figure 4-12: Surface water salinity (dS/m, maximum in January 2010) distribution in coastal area

River erosion

154. It is an ongoing disaster and there is no specific indicator to measure the extent of damage. River erosion in Bangladesh is no less dangerous than other sudden and devastating calamities. Losses due to river erosion occur slowly and gradually. Though losses are slow and gradual, they are more destructive and far-reaching than other sudden and devastating calamities. The effects of river erosion are long term. The disastrous riverbank erosion events are mainly associated with the major river systems of the country and are seen along the banks of the Brahmaputra-Jamuna, the Ganges-Padma, the lower Meghna, and other rivers. River erosion in the coastal area is not prominent than other part of the country. The disastrous river bank erosion mainly occurred in the lower Meghna River. The victim districts are Chandpur, Shariatpur and Bhola. River erosion not only causes displacement of people in this area, it also leads to massive financial loss

Arsenic contamination in groundwater

155. Arsenic contamination is considered to be a dangerous environmental threat and a serious health risk. It is identified as a public health emergency in Bangladesh. There is no specific treatment for chronic arsenicosis other than ceasing further intake of arsenic contaminated water and raising awareness of the population about the problem. The value (recommended limit) for arsenic in drinking water as per the guideline of the World Health Organization (WHO) is 0.01 mg/L while the national standard in Bangladesh, is 0.05 mg/L. With varying levels of contamination from region to region, groundwater in 61 out of the 64 districts in Bangladesh is contaminated with arsenic. According to a study conducted by the British Geological Survey and DPHE, about 57 million people in Bangladesh drink water that has an arsenic concentration greater than the WHO guideline value and up to 35 million people drink water that has concentrations in excess of the Bangladesh standard. Figure 4.13 shows that waters in the southwest and southeast parts of Bangladesh are highly contaminated with arsenic more than 0.05 mg/l, especially in Chandpur, Noakhali, Feni, Laxmipur, Khulna, Bagerhat and Satkhira districts.

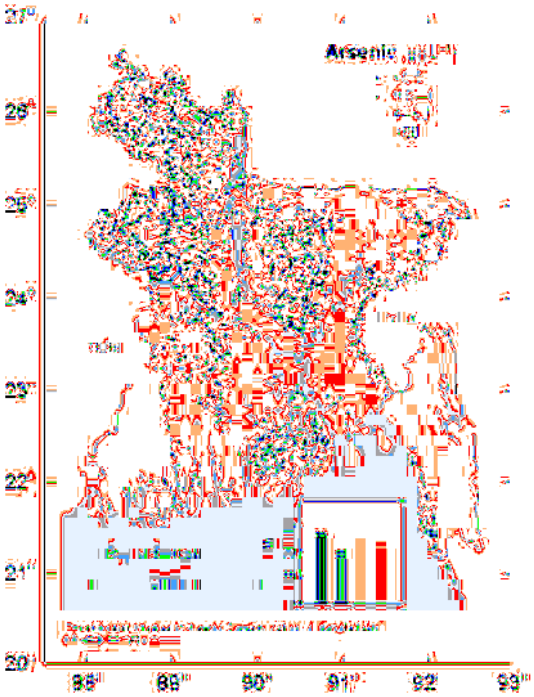


Figure 4-13: Groundwater Studies of Arsenic Contamination in Bangladesh (DPHE/BGS/DFID, 2000)

4.4 Socio economic conditions

156. According to the population census 2001, the total population of coastal area was about 28 million, which is about 22% of total population of Bangladesh. Adjusted population in 2010 was estimated about 31 million in the coastal area. Regionally the population is highest in Barisal (37%) and lowest in Noakhali (17%). The ratio of urban-rural population in the coastal region is 17:83. According to Population census 2001, the average population density is 719 per sq.km, average literacy rate is about 50% and average household size is 5.4 in the coastal zone.

157. The livelihood activities of coastal population are multidimensional. According to Population census 2001, agriculture, livestock and fisheries provide the principal source of income for around 60% of households in most parts of the coastal zone; although on the Chittagong Coastal Plain the proportion is lower (53%). In this area, there are more households whose income comes from services and employment in the commercial, industrial and government sectors than in other parts of the coastal zone – 23% compared with 15-16% in the GTP and about 20% in the MDP. Across the whole coastal zone, "business" provides the principal source of income for about 13% of households.

158. The economic activities of farmers usually are concentrated to land and water resource based activities such as agriculture, fisheries, salt farming, etc. Similarly fishermen are engaged mainly in fisheries, agriculture, fish related business, salt farming, etc. The economic activities of wage labors are more diversified than other groups, although most of them are engaged in agriculture works. Woman are usually engaged in household based works like homestead gardening, poultry and livestock farming, cottage industry, small business, fish fry collection, etc.

159. In some areas, especially along the eastern coast and in the area north of the Sundarbans, brackish water aquaculture is important for the production of shrimp. Along the east coast there is also widespread production of salt during the dry season, often in association with shrimp during the wet season.

160. Economic activity in this zone is subject to damage and disruption by cyclones and from tidal and erosion processes that are a permanent feature of the area. The vulnerability of the area and its population to these factors means that development of the area is partly dependent on measures taken to mitigate them. Protecting social and physical infrastructure and productive investments (in agriculture, industry and services) is an important component, in this zone, of the efforts to reduce poverty, improve livelihoods and increase economic activity.

161. In addition, a large part of the population has poor access to safe drinking water supply and sanitation and public health facilities due to poor infrastructures, communication system and natural hazards like arsenic and salinity. Improvement of the coastal polders may facilitate development of communication and infrastructures for supporting public utility services.

162. Moreover, there are local government institutions and NGOs working in the coastal region. However, they are not institutionally and financially very strong and are largely dependent on the central government or development partners, which limit development activities that could be taken by themselves on priority basis. Regarding water management, BWDB has been establishing Water Management Organizations (WMOs) for long time who can manage water management infrastructure in different projects. Nevertheless, the initiative was poorly implemented due to social conflict on sharing responsibilities and benefit/ loss of the projects.

4.5 Assessment of Intervention Requirement from Baseline Survey

163. It is found from baseline survey of the coastal polders that mainly two types of interventions, such as embankment raising/ repairing /re-aligning and construction/repairing of regulators and drainage cum flushing-inlet/sluice, will be implemented in most of the coastal polders in all the four zones. It is estimated that about 100% of embankments and 87% of total number of regulators and drainage cum- flushing inlet / sluice need to be either repaired or newly constructed in whole coastal area. About 70% of total number of inlets needs to be either repaired or newly constructed in whole coastal area. About 60% of total length of the drainage channels needs to be re-excavated in the coastal region. Distribution of each type of interventions with respect to total requirement in whole coastal area show that constructing/repairing of regulators, drainage cum flushing sluices/ inlets will be carried out mainly in GTPW and GTPE zones and drainage channel re-excavation works will be more or less equally required in all zones in coastal area. Table 4.6 summarizes the overall assessment of the possible and necessary interventions as observed in the field.

Table 4-6: Improvement works to be done for each type of interventions under CEIP project

Structures	**Whole coastal area**	**GTPW**	**GTPE**	**MDP**	**CCP**
Embankment					
Existing Embankment (km)	5460	1854	1940	878	690
Embankment repairing required (km)	Although small portion of embankment (about 50 km in whole coastal area) has been breached, almost all embankment need to be repaired/ raised to withstand the tidal/ storm surge in future				
% of total length of embankment to be repaired					
Regulators and drainage cum flushing-inlet/sluice					
Existing regulators and drainage cum flushing-inlet/sluice (No.)	1831	653	690	168	307
Regulators and drainage cum flushing-inlet/sluice to be repaired or newly constructed (No.)	1586	653	471	168	294
% of total number of existing regulators and drainage cum flushing sluice that need to be repaired or newly constructed	87%	100%	67%	100%	96%
Inlet					
Existing inlet (No.)	453	70	326	7	40
Inlet to be repaired or newly constructed (No.)	306	65	199	7	35
% of total number of existing inlets that need to be repaired or constructed	68%	93%	59%	100%	88%
Drainage channel					
Existing drainage channel (km)	7002	1887	2704	1341	892
Drainage channel to be re-excavated (km)	4256	1337	1418	978	523
% of total length of existing drainage channel that need to be re-excavated	61%	71%	52%	73%	59%

Chapter 5 : Analysis of Alternatives

5.1 Introduction

164. From the environmental safeguard view point, an alternative analysis is an important tool for the best selection of the project, implementation process, and operation mechanism in terms of environmental acceptability of the chosen method. Alternative analysis provides information about the advantages and disadvantages, quantifies the environmental impacts to the extent possible, and attaches economic values where feasible for each alternative considered. The alternative analysis for CEIP project will be conducted into two phases.

(a) Phase 1 will analyze the "no action" alternative of the project which will be reflected in this document and during embankment specific environmental assessment.

(b) Detail activities to be carried out for implementing the proposed interventions will depend on the design of the interventions. Phase 2 will conduct embankment specific alternative analysis for the project design, technical options, and implementation and operation method in terms of environmental impact. The second phase analysis will be conducted separately for each of the embankment and will be reflected in the Environmental Impact Assessment and Initial Environmental Examination report.

5.2 No Action Alternative

165. No Action Alternative means the future socioeconomic and environmental scenario of the area without any development in the coastal polder. This section presents the predicted status of the area without the project in the coastal areas considering the climate change and its impact.

5.2.1 Withstanding Climate Change and Storm Surge

166. Coastal area of Bangladesh is already vulnerable to natural hazards. It is expected that climate change will have further impact on the characteristics of the hazards such as cyclone and storm surges, tidal flooding and drainage congestion due to sea level rise (GoB, 2009). The existing structures of coastal polders are currently not functioning well in most areas. Baseline data of polders show that the existing crest level of the embankments is below the design level due to subsidence and top soil erosion. Analysis of the capacity of existing polders to withstand storm surge with climate change scenarios, carried out by IWM under current feasibility study of CEIP project, shows that most of the coastal polders will be overtopped by storm surge with return period of 25 year – 100 year. Some of the embankments can prevent only storm surge level with 10 year return period. Also, recent study shows that 14 interior polders and 30 sea-facing polders are likely to be overtopped by storm surge under the baseline scenario (2005) (Figure 5.1). The extent of overtopping in these polders increases under the climate change scenario for 2050 (with 27 cm sea level rise). Under the climate change scenario, 12 additional interior polders and 3 additional sea-facing polders may be overtopped (World Bank, 2010). Most of these polders are located in the Ganges Tidal Plain East (GTPE) zone in the coast area. A list of the polders likely to be overtopped is given in Appendix – 5.

167. As embankment were originally designed to protect against high tide without consideration of storm surges, without an upgrading of the embankment system, most coastal poldes are at risk from flooding from storm surges. Increasing the crest level of the embankment and widening their slopes through CEIP project will help to protect people living inside the polder (along with their asset) from storm surges, which are likely to worsen with the impact of climate change.

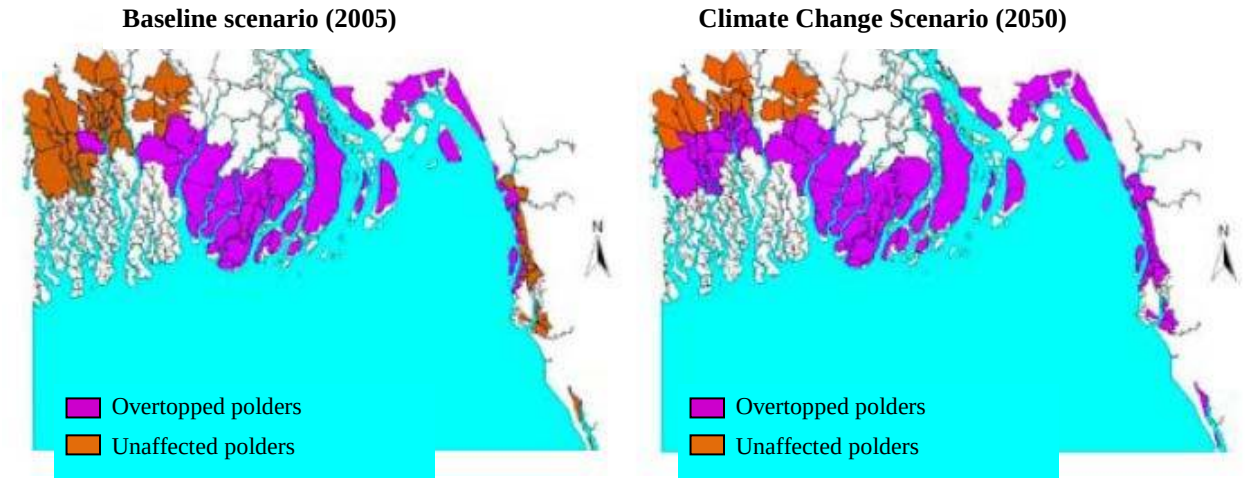


Figure 5-1: Overtopped Polders in Coastal Area Under Different Scenarios (*World Bank, 2010*)

5.2.2 Salinity Intrusion

168. Saline water intrusion is an important issue in coastal area and is very much related to climate change induced sea level rise. Depending on temporal and spatial variations, salinity affects the coastal ecosystem, fisheries, agriculture and public health. IWM and CEGIS (2007) estimated that more coastal area will be affected by high salinity due to future sea level rise than present saline affected areas. It is found that 1 ppt salinity line may move towards upstream by 10km to 20 km during monsoon, mainly in the central part (through Baleswar-Buriswar rivers) due to 27cm sea level rise and 62 cm sea level rise respectively. In Hatya and Manpura island in the Meghna Estuary, maximum salinity level may be increased to 3-5ppt for 27cm (in 2050) and 62cm (in 2080) sea level rise respectively (IWM and CEGIS, 2007) (Figure 5.2).

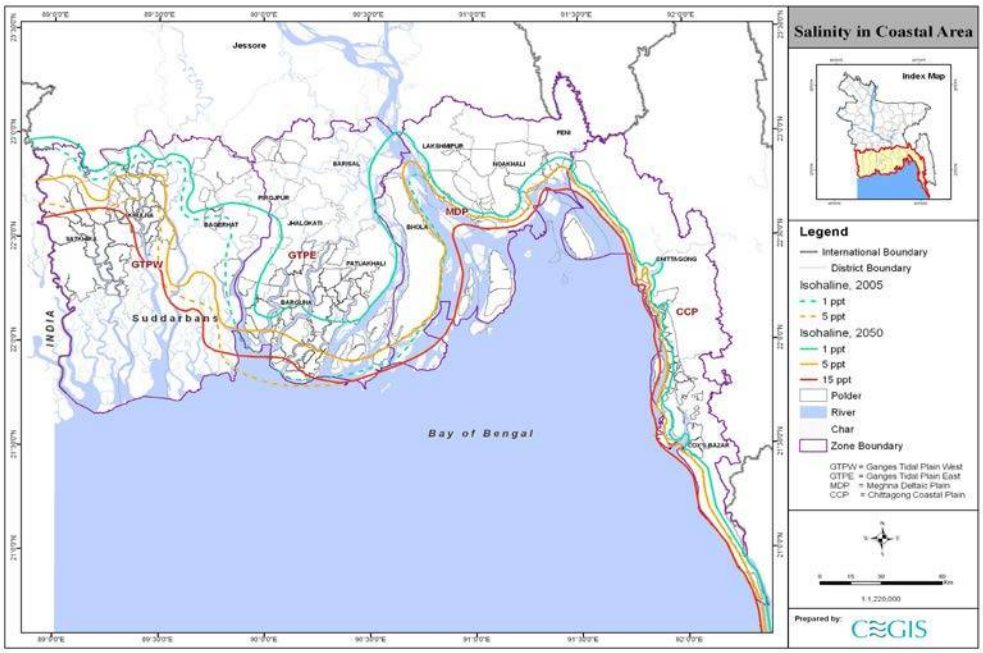


Figure 5-2: Salinity Condition In Coastal Area (for 2005 and 2050)

169. For the improved drainage system, or protection of saline water intrusion by embankment and water control structures through CEIP, the salinity problem will be reduced in the project area. With

proposed implementation work of retirement of embankment and replacement and new construction of water control structures, saline intrusion in khals, ponds water and other surface water sources will be prevented. Salinity will also be decreased due to flushing during wet season.

5.2.3 Drainage Congestion and Water Logging

170. Most of the internal khals are silted up and drainage and flushing sluices of the polder are not functioning properly which is a major reason of water logging/ drainage congestion in polder areas. If the present situation continues, the polder area will face **more drainage congestion** due to malfunctioning of water control structures and the continuous siltation in the internal khals. Especially drainage system will collapse if the regulators and flushing sluices remain in its damaged condition. After implementation of the proposed structural works, the drainage congestion would improve inside the project area. The project rehabilitation interventions, replacement of all regulators and flushing sluices with adequate vents and construction of new flushing sluices would significantly remove the drainage congestion and water logging problems in the polder areas.

5.2.4 Surface Water Availability

171. Availability of surface water would be reduced in ponds and other wet land areas, if there will be no initiatives to store water in internal khals by making the regulators functional. Due to unavailable upstream fresh water flow in some rivers like Bhairab-Bishnu and climate change induced changing rainfall pattern in South-west area of Bangladesh may create drought. Ground water table would also be depleted due to low rainfall or shifting of rainfall pattern and abstraction of excess ground water during dry season. Reserves of surface water for irrigation would be reduced due to silted up khals and malfunctioning of water control structures. With the implementation of the project, surface water availability is expected to be significantly improved when drainage system and water controlling structures will be implemented. After replacement and construction of new regulators with adequate vents, fresh surface water will be restored extensively in the internal khals and facilitate supply of irrigation water as well as recharge of ground water table.

5.2.5 Sedimentation

172. Presently, tidal inflow causes sedimentation in rivers and khal beds and also in the tidal creeks. A number of important khals of the project area have been silted up through the Surroundings Rivers. This rate will increase if the water control structures are not replaced. This massive sedimentation will reduce depth of the rivers and internal khals which will increase drainage problem and tidal wave action. Thus overtopping the embankment will be more frequent that will increase flood plain area of the polder, of proper action is not taken. Proposed interventions of structural and embankment works will reduce the sedimentation rate of the defined channels and will make the internal drainage system more active. Sedimentation will be reduced and tidal influence will increase after the structures with adequate vents are replaced and the embankment is strengthened as per implementation plan. The increased tidal prism will increase bed scouring in khals and rivers bed for smooth drainage of the polder area.

5.2.6 Soil Fertility

173. Soil nutrient status is dependent on the silt laden river water. If the project would not be implemented, most of the project area would remain submerged which would reduce some micro-nutrients availability of soils and would influence to deteriorate soil fertility. On the other hand, the surface water of the rivers contains silts of the river, which would contribute to increase the soil fertility. Full flood control may deprive the soils to receive the fine silts from the rivers.It is likely that river water flooding would sustain the soil fertility from further degradation. Similarly, the soils which are continuously irrigated with ground water may develop toxicity.

5.2.7 Agriculture

174. The agricultural land use will be degraded in absence of embankments, hydraulic structures, salinity intrusion and siltation of drainage channels. Under the without project condition, the farmers will be discourage to cultivate HYV Boro using surface water irrigation just after harvesting T Aman. If the interventions would not be implemented, the soil salinity would increase beyond critical limit (ECe> 4.0 dSm-1) and the availability of surface water in the river would decrease due to siltation.

5.2.8 Livestock

175. If the project is not implemented, the land type will be deteriorated and crop production will decrease. People of the coastal area will be desperate for raising the livestock and poultry for their existence. However, due to salinity intrusion and frequent submergence of land grazing areas are reducing. The interventions will help to protect the area from submergence by tidal saline water as well as flood from river water. The intervention may increase fodder for livestock/poultry. This will create very favorable environment for the expansion of livestock rearing in the area.

5.2.9 Fisheries

176. The water bodies e.g. internal rivers, khals, floodplain and borrow pit canal are present in the project area. Due to continuous siltation, water availability from internal river and khals would reduce especially in dry season. This habitat would become less suitable for fish habitation, production, diversity and migration in future without the project. CEIP will ensure proper operation of the existing sluice gate during fish breeding period which will facilitate fish migration and production.

5.2.10 Flora and Fauna

177. The aquatic and other habitats will be unchanged without any interventions. But increased water logging may reduce terrestrial habitats with negative impacts on terrestrial flora and fauna. Dying of terrestrial plants at the homestead and roadside is also caused by water logging. Practice of traditional shrimp farming by entering and storing saline water might change flora and fauna composition.

5.2.11 Socio-economic Condition

178. Currently the degree of seasonal as well as permanent out-migration is moderate. The rate is gradually increasing day by day as a consequence of low agriculture practice due to water congestion, salinity intrusion, cyclone, and drought, scarcity of drinking water and eventually low living standard. CEIP project is expected to increase agricultural production, employment opportunity and better communication.

5.3 Alternatives Analysis to Be Assessed During Design and Implementation Phase

179. Appropriately conducted alternative analyses are regarded as one of the most important measures to avoid and greatly reduce potentially adverse environmental and social impacts Alternative Analysis should be conducted during the feasibility study for finalization of design, technical options, and construction and operation method which will be reflected during the Initial Environmental Examination and Environmental Impact Assessment. This section outlines the tasks for alternative analysis during environmental assessment.

5.3.1 Alignment

180. The Environmental Assessment (EIA and IEE) should address the environmental analysis of the feasibility analysis to choose the alignment. The preferred option should be where possible to avoid impacts on ecosystems, biodiversity, physical cultural resources and communities. The EA should examine in details areas of particular potential environmental sensitivity. The assessment should include the environmental statement of the two sides of the alignment and reflect if major retreat has happened in last few years. For example, as shown in Figure 5.3 the embankment at Khuolia in Polder 35/1 was

observed to be badly eroded along its estuarine slope. To counter this BWDB have constructed a new retired embankment 100m landwards. Approximately 15-20 families live in between the retired and new embankment. If the alignment needs to be changed from the retreated one under CEIP the environmental analysis must reflect the environmental change due to the new alignment. If the retreated alignment is kept under CEIP the environmental analysis must reflect the environmental benefit for keeping the existing alignment.

Figure 5-3: Existing Alignment of Polder 35/1 at Khuolia

5.3.2 Drainage Facility

181. To provide adequate drainage facility the tasks will involve construction of hydraulic structure and excavation/reexcavation of drainage channels. The following are the key factors to upgrade the drainage facility to be considered:

- The comparative benefit analysis of choosing the new/replacement of hydraulic structure or excavation/reexcavation of drainage channels for facilitating proper drainage will be conducted from environmental perspective.
- The environmental impact of introducing new/replacement/repairment of new drainage facility will be considered in terms of location, need, number, type and economical benefit.
- In case of replacement of hydraulic structure, a comparative analysis between the current hydraulic structure and new one will be presented in terms of environmental benefit considering the type of structure, runoff and tidal surge.

5.3.3 Construction Method

182. Designs should be justified economically, and the optimum choice will vary with regard to choice of construction method.. Construction costs will be related to type of material chosen transportation cost of the material, necessity of constructing/repairmen of hydraulic structure, optimum crest height to withstand possible tidal surge and availability of labor in the local areas.

5.3.4 Sources of Material

183. Different types of construction materials such as soil, sand, concretes, wood, bamboo, metals, etc. will be required for implementing the project interventions under CEIP. The types, amount and source of construction materials are not yet determined. Usually construction materials are collected from local markets and suitable places. Especially, soils, required for earth works, would be collected from locally suitable land in the polders and from the excavation/re-excavation of drainage canals considering the required soil quality. The EIA for each polder should reflect the possible sources of material and justified location of the sources of material and analyze the environmental impact for each reconstruction/repairment of embankment in segment.

5.3.5 Disposal of Sludge Material

184. Within the CEIP polder areas, sedimentation process is accelerated due to controlled water flow in the channels and improper maintenance of the water control structures and channels. In many cases, river bed level outside the polder has become higher than the river beds inside the polder, which resulted in malfunctioning or non operation of regulators/ sluice gates. Consequently, permanent water logging has been created in many polders. The CEIP should take care of these issues while designing and implementing the improvement works in coastal polders. The re-excavation of channels and sludge materials need to be carefully managed.

5.3.6 Protective Measures for Reducing Bank/Embankment Erosion

185. Afforestation in the foreshore and embankment and concrete block placing are the two options chosen as protection measures for reducing bank/embankment erosion. Technically the choice will be made based on the land availability for afforestation/biological treatment and exposure of the embankment to the loads . The alternative analysis will analyze the environmental benefit from choosing the certain type of protective measure for each polder.

5.3.7 Location and Type of Plantation

186. Dense vegetative cover of grass turfs on the slope and afforestation of the embankment toes as well as the foreland areas increase the stability of the earthen embankments in coastal areas. The study will contribute in selecting planting material to be raised from seeds originating locally and match well to the local site conditions. The species mixture has to respect the individual growth characteristics and to be geared to generate synergies in the vegetation cover and improvement of soil quality. The study will also reflect polder wise various types of plantation for slope. toe, berm and borrow pit.

5.3.8 Location for Labor Camps

187. Some labor camps would be established in construction sites during construction period. The EIA should look for alternative analysis for possible locations of labor camps which will have minimum effect on the surrounding environment without hampering the project activities. For example, sometimes labor camps are chosen inside the school compound or in the class rooms due to proximity to the project location and water and sanitation facility availability which has significant negative impact on the education environment.

Chapter 6 : Possible Environmental Issues with Mitigation Measures & Benefit of the Project

6.1 Introduction

188. The environmental impacts identified at this stage are preliminary in nature and will need to be further analyzed specifically for activity wise and potential for occurrence has to be ascertained during IEE/EIA and preparation of the EMPs. The potential impacts will be identified during various stages of the project activities: preconstruction, construction and operation..

189. The EMF considers the analysis of the overall coastal polder and should be considered for **guidance** purpose but the exact study area for different environmental attributes (water, air, noise, soil etc) is to be submitted considering the proposed activities and location, alignment and along with proper reasoning, for identifying exact impact and related mitigation measures. The project influence area will be selected accordingly.

6.2 Environmental Impacts due to Rehabilitation and Improvement of Polders System

190. Once the polders or hydraulic structures are constructed/reconstructed/rehabilitated, the environmental setting of the area might change and consequently the changed natural environment may impacts the polders. Moreover, the embankments themselves will induce some development in their areas, especially the embankment-side areas. Thus broadly there are nine sources of environmental impacts from embankment improvement as below:

(a) improvements of critical portions of the polders embankment;
(b) restoration of embankments and channel improvement in critical stretches;
(c) increasing embankment height;
(d) upgrading drainage systems within polders by excavation/reexcavation or introducing hydraulic structure
(e) earthworks
(f) bricks and aggregates
(g) source of material
(h) disposal of excavated wastes
(i) induced impacts from embankment improvement

6.2.1 Design Issues& Mitigation

191. In the Design Stage the main activities of the project are:

(a) Study to select best alignment of the polders.
(b) Identify the need, type and best location of the drainage structure
(c) Determine the need for dredging to avoid water logging within polder area
(d) Further investigation on geo-engineering to detailed design of the polder section, drainage structure.
(e) Design polder, drainage structure and other technical facilities.
(f) Acquire land, relocate houses and infrastructural facilities; remove vegetation covers within the project for construction/reconstruction/rehabilitation of polder, bridges and other technical facilities.
(g) Implement resettlement action plan (RAP).
(h) Identify the sources of material.

192. Due to implementation of the project the following potential negative impacts will be occurred if these are not properly addressed during design phase:

- **Damages due to Project Intervention and Land Acquisition**

Issues: The project will need to acquire land to construct embankments and water control structures. House, shops common properties vegetation will be affected by the project interventions. The significance of this impact is expected to be major.

Mitigation- The project will conduct the alternative analysis for the alignment of polder considering environmental, economic and social benefit. The project intervention should consider minimum disturbance of infrastructures, people and vegetation. The resettlement cost estimate should be performed before hand which will include compensation for land acquisition, structures, trees, fish stocks, capacity building training for Environmental Assessment.

- **Loss of Agriculture Land**

Issues- Agricultural land may be permanently lost in case of realignment/retreatment of a certain section of the polder. It has been observed realignment/retreatment of many segments have already done in the field. In terms of loss of agricultural land the loss is irreversible.

Mitigation- The technical study should incorporate the necessary information about requirement of retirement/realignment of the polder. Consider realignment option for polders to avoid minimum encroachment of agricultural land. In the long run it is expected the polder will have more cultivable land. If possible, the farmers can be encouraged to cultivate high yield varieties for increasing cropping intensity in the remaining cultivable land during construction.

- **Noise Quality**

Issues - Mobilization of construction vehicles for equipment and material transport will deteriorate the noise level at the surrounding sites. The traffic volume will be increased both in the road and river. The polder protected area is populated and number of common infrastructure like schools, madrasa, mosques is inside the polder. The increased traffic volume is anticipated to increase the noise pollution.

Mitigation – The contractors need to aware the vehicle drivers not to use hydraulic horns and to avoid unnecessary honking. The contractors should encourage the vehicles to come during day time.

- **Loss of Trees**

Issues – There will be loss of trees during pre-construction stage due to clearing of land for base widening of polder, realignment of polder in some areas and establishment of construction camps.

Mitigation –During impact assessment the information about size, species and number of trees should be recorded. The project has an afforestation component. The component should prepare an afforestation plan based on the local species and number of trees cut. This will reduce the negative impact substantially in the long run. The overall impact is expected to be negative to positive in the long run. However, there will be a transition phase of impact between immature tree at early stage and matured tree at the later stage.

- **Fisheries**

Issues-The construction of embankments and dredging of canals have important consequences on flood plain ecology. The fish spawning will be impacted if canal excavation happens during spawning period.

Mitigation- The technical study should incorporate the necessary information about requirement/ repairment of hydraulic structure and the species to be affected by canal excavation. The fish migration route should be determined before commencement of the work. The following actions can be considered to mitigate adverse impact on fisheries:

- ✓ The canals of conservation importance should be identified during design phase
- ✓ Adequate opening or providing fish pass along the routes of fish migration can minimize negative impact on fish migration
- ✓ The loss can be compensated by promoting fish culture.

- **Increased Vehicular Traffic During Mobilization**

Issues- During contractor mobilization, equipment, machinery, material, and manpower will be transported to the Polder resulting in additional traffic on roads and in waterways. This traffic may potentially cause traffic congestion particularly at roads and jetties.

Mitigation - The following measures will be implemented to address the above concerns:

- ✓ The contractor will prepare a traffic management plan (TMP) and obtain approval from the Contractor Supervision Consultant. The TMP will be shared with the communities and will be finalized after obtaining their consent. The TMP will be submitted with the Environmental Action Plan (EAP)
- ✓ The TMP will address the existing traffic congestion and traffic movement will be avoided during the school time.
- ✓ Project-related traffic will be minimized during the peak traffic hours (from 8 am to 2 pm).
- ✓ Ensure minimal hindrance to local communities and commuters.
- ✓ Liaise with local communities and concerned authorities

- **Preparation of Facilities for Contractors and Labor Force**

Issues- Establishing the contractor's temporary site facilities may involve land clearing, land leveling, excavation, and construction of buildings. These activities may potentially cause air and water contamination, noise generation, safety hazards, hindrance to local communities, and other similar impacts. The locations will be temporarily established. The contractor will propose the possible location of construction yards

Mitigation- The following measures will be implemented to address the above concerns:

- Contractor will prepare site establishment plan and obtain approval from the Construction Supervision (CS) consultant and share with the EAP
- Approval from CSC will be obtained for the location of temporary facilities.
- Tree felling and vegetation clearing will be minimized to establish site facilities
- Photographic record will be maintained to record pre-construction condition of the area
- Site facilities will be established at a safe distance from communities
- Contractor will prepare and implement pollution control and waste management plans
- No untreated wastes will be released on ground or in water
- Exhaust emissions from vehicles and equipment will comply with standards
- Vehicles, generators, and equipment will be properly tuned.
- Water will be sprinkled where needed to suppress dust emissions
- Speed limits will be enforced for vehicles on earthen tracks
- Vehicles and machinery will have proper mufflers and silencers
- Liaison will be maintained with the communities

- **Drainage congestion/Water Logging**

***Issues*-**Embankments can cause drainage congestion in adjacent areas during period of high rainfall. If the high tide exceeds the height of embankment, due to inadequate water outlet, water logging will occur. This may cause crop damage, and in extreme cases permanent loss of agricultural lands.

***Mitigation*-** Excavation/Reexcavation of drainage channels needs to be considered during design phase, if drainage congestion triggers from any activities, reconsider the location of hydraulic structure and alignment of embankment to avoid any drainage congestion.

- **Sources of Material for Earthwork**

***Issues*-** Collection of material is a challenge for the project. Earthwork material is expected to be collected locally. The presences of continuous borrow pits on a riverside induces undercutting of the embankment toes and slopes due to complete inundation of the riverbank or seashore during the monsoon. The borrow pits and adjoining low-lands thus inundated induce a parallel water current to flow along very near the embankment toes and thereby eroding the surfaces rapidly.

***Mitigation*-** During design the segment wise soil requirement and location of the sources of soil for earthwork for each polder construction/rehabilitation should be identified. The borrow pit chosen for the sources of material should be discontinuous, on the land side and away from the toe line.

- **Disposal of Dredged Material**:

***Issues*-** Dredging will be carried out in the silted drainage channels inside the polder. The spoil material obtained from the dredging activity may create hazards on habitat, sediment and water quality.

***Mitigation*-** Contractor in consultation with the DoE will submit a spoil plan for approval. The spoil plan should show the location of proposed sites (landfill or borrow pits) to be used and the measures to be taken to rehabilitate these pits upon finalization of the Project. Costs of the spoil disposal will be included into cost break-down provided by contractor within bidding proposal and should be reflected in the contract It is also recommended to utilize any dredged material for the reconstruction/rehabilitation of the polders. However, the soil quality of the dredged material should match the specified requirement of soil quality applicable for reconstruction/rehabilitation of coast polder. Suitable access to the materials will be agreed with the local authorities in consultation with the community. The key information to be collected before commencing dredging is as follows:

1. the volume to be dredged;
2. the disposal site to be used;
3. quality of dredged material;
4. applicability of the dredged material for reconstruction/construction/rehabilitation of polders
5. any new pollution sources or known incidents (i.e., a spill) that have occurred which might impact the quality of sediment to be dredged.

- **Flooding**

***Issues*-** If Tidal River Management (TRM) is followed in some Embankments that may create flooding in the low lying area.

Mitigation- If TRM is followed at any embankment; the design consultant should conduct detail study about the regional hydraulic regime specially the flooding pattern, flow of water, ground water table during design. TRM is not encouraged at any site without detail investigation.

- **Public cuts**

Issues- Public cuts and tubes linking a river or seaside with the country side of its embankment are frequently observed. These cuts weaken the embankments, exposing them to slow but continual erosive forces. During flood or cyclonic storm, breaching or major erosion occurs at those points. The people mainly cut the embankments to fulfill their purposes:

- To get rid of the poor and inadequate drainage conditions of the existing structures, they arrange quick removal of excess floodwater from the polder area to the river or the sea.
- They create temporary irrigation inlets for applying sweet river water to the cropping fields when there are prolonged droughts in the polder area.
- For short-term economic purposes yielding individual-level benefits, sometimes people allow river or seawater to penetrate inside the polder for shrimp cultivation or any other fishing requirement or salt panning.

Mitigation- Adequate consultation should be carried out segment wise for each polder during design phase to avoid creation of temporary irrigation inlets and penetration of salt water for shrimp cultivation.

Responsibility

- The design consultant will incorporate the environmental issues in the technical design with the help of environmental specialist.
- BWDB will endorse the environment friendly technical design.
- BWDB can seek assistance of independent environment specialist input for ensuring environmental impacts have been addressed in the design adequately.
- The Contractor will address construction related activities planning in the Environmental Action Plan prepared by the contractor in line with the construction work plan

6.2.2 Impacts during Construction & Mitigation

193. Generally, construction impacts are expected to last for a relatively short time period and are expected to cease soon after the completion of construction. Construction impacts are considered to be minimal as all the construction works will be carried out within the site boundary on the acquired land and will be controlled via the mitigation measures defined in the EIA for each polder. If Contractor does not comply with the environmental specifications, serious long term environmental problems could emerge.

- **Drainage Congestion and Water Logging**

Impact- The Project activities particularly on regulators and sluices and in water channels may block or clog water drainage channels, potentially causing temporary water logging in the surrounding areas and negatively affecting the cultivation and the associated communities. In addition, excavation *khals* in the Polder is likely to disturb the drainage which takes place through these channels.

Mitigation- The following measures will be implemented to address the above concerns:

- ✓ Contractor will constructing bypass canal before construction of each regulator particularly to the major drainage channels in the Polder,

- ✓ Sequence of work at the regulators and in the water channels will be carefully planned to avoid drainage congestion.
- ✓ Contractor and CS will ensure that drainage channels are not obstructed or clogged by the construction activities
- ✓ Contractor will ensure that construction activities do not cause any water ponding near cultivation fields.

- **Air Quality**

Impact- Construction machinery and Project vehicles will release exhaust emissions, containing carbon monoxide (CO), sulfur dioxide (SO_2), oxides of nitrogen (NO_X), and particulate matter (PM). These emissions can deteriorate the ambient air quality in the immediate vicinity of the Project sites (particularly along the embankment, and around the channel excavation sites and borrow areas). Furthermore, construction activities such as excavation, leveling, filling and vehicular movement on unpaved tracks may also cause fugitive dust emissions. These emissions pose health hazards for the nearby communities as well as for the construction workers. In particular, the settlements near the work areas will be exposed to air contamination caused by the Project activities.

Mitigation - The following measures will be implemented to address the above concerns:

- Demolition of the regulators will not be carried out during the school time (8 am to 1 pm) particularly near the schools
- Exhaust emissions from vehicles and equipment will comply with standards
- Proper tuning of vehicles, generators, and equipment will be carried out, to minimize exhaust emissions.
- Construction material (sand/soil) will be kept covered while transporting and stock piled.
- Water sprinkling will be carried out where needed, particularly on the earthen tracks near communities.
- Vehicle speed will be on low (15 km per hour) on earthen tracks particularly near communities.
- Vehicles and other machinery will be turned off when idle
- Good quality fuel will be used, minimizing exhaust emissions.
- Camps will be located at a safe distance from communities.
- Liaison with the communities will be maintained and grievance redress mechanism will be established at the site.

During construction the handling and transport of construction material, earth movement, raising height of the embankment and excavation may cause dust, noise and air pollution.

Mitigation-Impacts during the transportation and storage of construction material will be minimized by covering the material or by keeping the surface wet.

- **Soil Quality**

Impact-Establishment of working areas, earthwork and storage of construction materials at the project site may cause damage to soil. The main impacts on the soil during construction are from (i) loss of topsoil from the construction sites; (ii) conversion of the existing land uses such as agriculture and plantations to stockpiles of materials, and damage to the temporarily acquired land; (iii) cut and fill operations, (iv) extraction of fill materials from cut section, and/or borrow pits, (v) soil erosion slope of the embankment, borrow pits and un-compacted embankments and siltation, and (vi) contamination of the land from hazardous and toxic chemicals and construction material spillage. In addition site preparation activities generate spoils consisting of crop residue, grasses, trees and earth (ADB, 2011).

Mitigation- Removing the topsoil from the storage sites and storing it in a secure place for later use would mitigate these impacts. After the completion of the construction, the topsoil would be placed to its original place. In areas of no topsoil construction material can be stored directly on top it. However, after the construction, the area would be turfed and trees planted. The storage of topsoil in stockpiles, no more than 2m high with side slopes at a maximum angle of 45^0, will take into consideration the following:

- Segregation of the topsoil from the subsoil stockpiles
- Dedicated storage locations that prevent the stockpiles being compacted by vehicle movements or contaminated by other materials;
- Segregation from subsoil stockpiles;
- No storage where there is a potential for flooding;
- No storage at less than 100 m from river/streams, subject to site specific topography.

- **Noise and Vibration**

Impacts- The construction activities particularly demolition of existing structures, excavation, compaction, operation of construction machinery, and vehicular traffic will generate noise and vibration which are likely to affect the nearby communities. In addition, camp sites may also generate noise.

Increased noise levels may cause disturbance, nuisance and even health hazards for the nearby communities as well as for the construction workers. In particular, the settlements near the work areas will be exposed to noise and vibration generated by the Project activities; in addition sensitive receptors including nine schools along the embankment are likely to be more severely affected by noise

Mitigation-Regular maintenance of construction equipment and vehicles in accordance with manufacturers' maintenance procedures will greatly reduce the noise levels. Contractors are recommended to monitor the noise levels regularly at the construction sites and take necessary measures to comply with the national standards. High efficiency mufflers are to be fitted to the noise generating equipment. The construction related activities will be restricted between 0600 to 2100 hours.

- **Surface Water Quality**

Impacts - There may be some water pollution from the construction site, labor camps and disposal of dredged material etc.

Mitigation - To mitigate this, the following measures will be taken:

(i) Provide and maintain appropriate facilities for temporary storage of all wastes before transportation and disposal.

(ii) Organize disposal of all wastes generated during construction in an environmentally acceptable manner considering the nature and location of appropriate disposal sites.

(iii) During dredging operations, the overflow silt and clay content may increase turbidity of surface water. To overcome this, the site of dredging should be shifted to places where the clay and silt content is low enough to maintain the turbidity within the water quality standards.

- **Impacts of Fish Habitat**

Impacts **-** Construction activities on the sluices can potentially affect aquatic habitat and fish migration in the khals. Though the habitat in these khals is already modified as a result of construction of embankments and sluices in 1960s, some fish migration between outside rivers and internal khals still takes place particularly along those, which do not have any water control structure. During the construction activities, the fish migration between the outside rivers and internal *khals* is likely to be

affected. Similarly, fish migration within the Polder between *khals* and *beels* can also be affected by the construction activities particularly the *khal* excavation.

Mitigation -The following measures will be implemented to address the above concerns:

- ✓ Contractor will constructing bypass canal before construction of each regulator
- ✓ Sequence of work at the regulators and in the water channels will be carefully planned to minimize impacts on fish and their migration.
- ✓ Fish (particularly juvenile fish) will be transferred from rivers to Polder water channels where appropriate.
- ✓ Contractor will maintain liaison with communities.

- **Impacts on Benthic Fauna**

Benthic communities play important role in food chain not only for lentic (standing water) but also for lotic (flowing) water bodies. Construction activities including re-excavation of *khals*, dredging of rivers and discharge of solid wastes and waste effluents can potentially impact the benthic communities of the water bodies. Most of the construction activities will be implemented during dry season, during which time the benthic fauna would be more vulnerable.

Mitigation**-** The following measures will be implemented to address the above concerns:

- Contractor will not release untreated wastes on soil or in water.
- Contractor will carry out *khal* excavation in segment thus minimizing impacts on benthic fauna.

- **Borrow Pit for Sources of Material**

Impact-Generally borrow pit sites are the major sources of environmental impact due to dust and noise pollution, loss of biodiversity, and generation of spills. Operation of the quarries above the approved limits may cause change of floodplain hydrology and trigger erosion and landscape degradation.

Mitigation- The mitigation plan to be followed by the Contractor at the borrow sites is: (i) only borrow areas approved by the environmental authority will be used for the project; (ii) pits management will be in full compliance with all applicable environmental standards and specifications; (iii) the excavation and restoration of borrow areas and their surroundings, in an environmentally sound manner to the satisfaction of the DoE; (iv) borrow pit areas will be graded to ensure drainage and visual uniformity. Additional borrow pits, if necessary, will not be opened without the restoration of those areas no longer in use, and without the approval of DoE. Topsoil from the opening of borrow pits will be saved and reused to revegetate the pits or turfing the embankment (ADB, 2011).

- **Effects on Irrigation**

Impacts **-** Irrigation is vitally important for the agricultural activities in the Polder. Construction activities particularly on regulators and in water channels can potentially disrupt the crop irrigation thus negatively affecting cultivation. The works on sluices can cut off the incoming water from the river, while the excavation works in water channels can affect water conveyance through them.

Mitigation -The following measures will be implemented to address the above concerns:

- ✓ Contractor will constructing bypass canal before construction of each regulator
- ✓ Sequence of work at the regulators and in the water channels will be carefully planned to avoid irrigation disruption.
- ✓ Contractor will ensure no negative impacts on crop irrigation
- ✓ Contractor will maintain liaison with communities.

- **Loss of Agricultural Lands**

Impacts - Improving the rural embankments by widening/or increasing height will cause embankment-side agricultural land loss. Agricultural production may be slightly reduced during the implementation of the Project because of construction of labor camps, approach roads, storage sites for construction materials, sites for preparation of concrete blocks, transportation of construction material, etc.

Mitigation -It is expected that the contractor will establish camps for laborers and permanent staff supervising, directing, and controlling the works. The owners of the land for these camps will be compensated, and the land restored after demobilization. After construction the agricultural land will be reinstated to its former state, wherever possible.

While it is not possible to avoid the agricultural lands, the mitigation measure is to provide steep slopes for the embankment by applying improved soil stabilization means to minimize the land loss. Among others grass turfing or vetiver grass plantation could be effective means in minimizing erosion.

- **Construction Camp**

Impacts - The potential implications associated with housing of immigrant workforce include generation of solid waste, adverse water quality impacts arising from discharge of partially treated sewage and refuse, public health impacts through the possible introduction of diseases not prevalent in the surrounding areas, social-cultural conflicts arising from religious, cultural and behavioral discords between immigrants and local residents, and promotion of un-aesthetic practices.

Mitigation -It is strongly recommended that the contractor should hire local workers as many as available. The camps should have adequate housing for all workers, safe and reliable water supply, fuel supply, waste disposal facilities, hygienic sanitary facilities and sewerage system, treatment facilities for sewerage of toilet and domestic wastes, storm water drainage facilities, adequate health care facilities, and in-house community/common entertainment facilities. Contractor has to prepare a detailed layout plan of the construction camp and submit with the bidding document. The Contractor shall conduct ongoing training programs to all construction workers on basic sanitation and health care issues and safety matters. The contractor shall restore all the construction camps to original condition after completion of civil works.

- **Water Supply**

Impacts - During the construction phase some tubewells may have to be relocated and some people using the river as their source of drinking water may face inconvenience. This may have a minor local negative impact.

Mitigation - To mitigate any such impact the contractor will be required to establish an alternative water supply.

- **Occupational Health and Safety**

Impacts- The construction activities will involve operation of heavy construction machinery, vehicular traffic, excavation and filling operations. These activities may pose some safety hazards to the local population as well as for the construction workers. The fuel storage at the camp sites may also pose safety hazards for the construction staff as well as for surrounding population.

Inappropriate waste disposal at the camps and construction sites, and air quality deterioration caused by the Project's vehicular traffic and construction activities potentially pose health hazards for the

construction staff and nearby population. Unhygienic condition and unavailability of safe drinking water for the construction staff will expose them to health risks. In addition, influx of construction staff can potentially expose the nearby population to communicable diseases.

In addition, if proper safety measurement is not taken ion borrow pit or stock piling of materials, dredged material severe accident may happen to the local community.

Mitigation-Residents must be able to cross the road safely and particular attention must be given to vulnerable groups such as children, the elderly, and animals. All vehicles should observe speed limits and load restriction.

The contractor shall instruct his workers in health and safety matters, and requires the workers to use the provided safety equipment. The scope will need to include transmittable diseases establish all relevant safety measures as required by law and good engineering practices. The contractors will be responsible for the provision of first aid facilities, rapid availability of trained paramedical personnel, and emergency transport to nearest hospital with accident and emergency facilities. The contractor will be responsible for ensuring that all construction vehicles observe speed limits on the construction sites and on public roads.

The contractor has to come with a safety plan about the stock piling of earth material and borrow pit area and submit that with the EAP. The construction sites will have protective fencing to avoid any unauthorized entry, where appropriate and possible

Responsibility

- The contractor will incorporate the environmental issues and related costing in the bidding documents and technical proposal with the help of environmental specialist.
- BWDB will supervise implementation of the environmental management during construction
- BWDB can seek assistance of third party environment specialist/supervision consultant input for ensuring environmental impacts have been addressed adequately during construction.

6.2.3 Impacts during Operation & Maintenance phase and Mitigation

194. Due to increased activities and efficient operational systems, there will be some potential impacts on the environmental set-up in the coastal area. In order to achieve sustainability of the development works, it is necessary to ensure the effectiveness of mitigation measures even after construction, as some adverse environmental impacts may result from the operation of the project facilities. The potential adverse impact during operational phase are discussed below:

- **<u>Operation of Hydraulic Structure</u>**

Impacts- Operation time of Hydraulic Structure can create tension/conflict among the people living in the nearby areas. Agriculture production may be hampered by saline water intrusion where as saline water is the pre-requisite for shrimp farming. Improper operation of hydraulic structure during rainy season or after storm will create water logging. To release the excess water or to let the saline water to enter inside the polder public cut may occur.

Mitigation-BWDB should have trained operator on hydraulic structure operation/control mechanism and time. Water Management Organizations (WMOs) should be involved in operating and maintaining the hydraulic strcutures. The hydraulic structure operation should be based on the need of maintaining minimum water level requirement, agricultural requirement and to remove water logging.

- **Risk of Embankment Failure**

Impacts - Rain cuts and public cuts are the major causes of embankment breaching of the Polder. Lack of regular maintenance has created weak point at the sensitive locations of the embankment. Mal-maintenance and increasing intensity and magnitude of the cyclone and storm surge simultaneously have accelerated the risk of embankment failure.

Mitigation - The following measures will be implemented to address the above concerns:

- Regular monitoring and careful maintenance of the embankment and existing water control structures will be ensured. This monitoring will particularly be carried out before and after monsoon season.
- Available cyclone and flood shelter will be prepared as a contingency measure during emergency situation.
- WMO will develop a fund for this kind of emergency situation.

- **Blockage of Streams**

Impacts –Soil Erosion from the polders and lack of sedimentation management will create blockage of streams.

Mitigation-BWDB should take quick repairment measure at early stage in case of any erosion of the polders and should take appropriate measure for ensuring proper sedimentation management.

- **Soil Erosion**

Impacts – Erosion from soil surfaces results from the kinetic energy of raindrops and flowing water. Raindrops dislodge soil particles, and runoff flowing downslope can suspend and transport the loose particles. Livestock and human traffic on polders encourage erosion. Holes created by rodents in the polder also increases possibility of soil erosion.

Mitigation-The tops of embankments not routinely used as roads should be covered with grass. Embankment tops subject to regular traffic can be paved or covered with a 2- to 3-inch layer of coarse brick/gravel.

- **Drainage Congestion and Increased Sedimentation in Water Channels and Rivers**

Impacts- Drainage congestion is a key issue in southwest zone of Bangladesh. This problem is localized and reversible by proper re-excavation of khals. It is a recurring problem and silt deposition in the rivers outside and water channels inside the Polder is likely to continue. Particularly, the low lying areas of the Polder and tail ends of *khals* may face severe drainage congestion in the future.

Mitigation- The following measures will be implemented to address the above concerns:

- An ongoing program of de-silting of water channels will be considered with full community involvement and participation. WMGs will take the lead for this purpose.
- Proper land zoning plan will be prepared in the Polder for controlling unplanned development works.
- The local government (union parishad) will be authorized to monitor the development activities.
- Proper training program in connection with land zoning and monitoring system will be undertaken by the development authorities of Bangladesh.
- Prepare Bangla manual for sluice gate operation and provide training to WMOs; and

- Reduce conflicts between farmers and fishermen.

- **Increase Salinity Intrusion Due to Leakage of Regulators**

Impacts – Mal-operation and leakage of regulators will result in salinity intrusion during the low flow season, causing severe damage to the soil, water resources, and crops in the Polder. The Proposed project has been designed to address such damages which are currently caused by the salinity intrusion. Mishandling and or poor upkeep and maintenance of these control structures will undermine the very objective of the Project.

Mitigation- The following measures will be implemented to address the above concerns:

- Regular monitoring and careful maintenance of the water control structures will be ensured.
- Standard operating procedures will be prepared and implemented for the water control structures. These procedures will be translated in Bangle as well.
- Capacity building of WMOs will be carried out.

- **Reduced Fish Migration**

Impacts - Construction of new water control structures on water channels which are currently directly connected with the outer rivers will potentially result in reduction in fish migration. This can potentially result in decrease of fish population in the Polder thus adversely affecting the fish catch and fishermen.

Mitigation- The following measures will be implemented to address the above concerns:

- Proper sluice gate operation allowing fish migration.
- Provide training to WMOs about sluice operation;

- **Nuisance plant**

Impacts – The borrow pits often harbor nuisance plants like water hyacinth which invade the croplands during flood and cause considerable crop damage.

Mitigation-The nuisance plants should be regularly destructed. The destructed plants can be converted into compost for application as soil conditioner/manure. Community can be involved in this action.

Responsibility

- The community will be trained by BWDB and involved in the operation and maintenance
- BWDB will ensure and supervise implementation of the environmental management during operation
- BWDB will be responsible for the operation and maintenance
- BWDB can seek assistance of third party environment specialist/supervision consultant input for ensuring environmental impacts have been addressed adequately during operation and maintenance.

6.3 Environmental Impacts due to Afforestation

195. Afforestation without appropriate planning and management techniques destroys the undergrowth grass cover and becomes ineffective for erosion protection. In such cases, afforestation results in the weakening of the embankment without any substantial contribution to its stability.

196. To achieve and to maintain the desired biological protection, the following conditions were identified as the main prerequisites:

- a proper setback of the embankments
- good-quality earthwork and selection of suited soil material
- improved design of the embankment physical structure
- systematic good turfing/plantation
- an optimal management of riverbanks and shores and
- adequate maintenance

- **Site Specific Planting Material Selection**

Impacts- Site specific Plantation selection will be an important steps for project preparation. If the site and plantation selection are wrong, project activities will trigger adverse impacts on the local environment and cultural heritage. Distribution of planting land and species is not only affects the efficiency of mixed forests but also the habitat of wildlife and the landscape of nature reserves.

Mitigation-Planting material selection needs to be raised from seeds originating locally and match well to the local site conditions. The species mixture has to respect the individual growth characteristics and to be geared to generate synergies in the vegetation cover and improvement of soil quality. Otherwise, the plantation will not bring the expected benefits. The type of planting species should be selected according to the locations. For example, the raised foreshore land of the embankment which is subject to occasional inundation by very high tide is not suitable for mangroves. But certain terrestrial species could be tested.

- **Pesticides**

Impacts- During any plant disease outbreak, the borrower may need to use pesticide. The misuse of pesticide will cause adverse environmental impacts. The application of pesticides can kill the natural predator of harmful insects, and cause biodiversity decline and the unbalance of species. The pesticide can pollute water supplies and soil, and endanger the health of the residents, livestock, crops, and wild animals, directly or indirectly. And the pesticide spraying equipment will contaminate the water and soil if not cleaned correctly.

Mitigation-Plant diseases and insect pests control should use precaution and microbiological processes. The 1st species of first and second category of pesticides are forbidden to use. The first year of the planting farmyard manure will be applied and then the organic fertilizers will be used after. These will improve the physical and chemical properties of soil, and cause slight adverse environmental impact. Besides, the packing receptacle of the pesticides and fertilizers should be collected and treated centralized, and also the vessel must be forbidden to wash in the river or lake.

- **Polypropylene Bags used for Seed Germination**

Impacts- One nursery is expected to be established for every five hectares of plantation. Due to the humid weather effect of Bangladesh, Bangladesh uses cost effective plastic (poly propylene) bag instead of biodegradable bags for seed germination. Use of polythene is banned in Bangladesh. PP bags are non degradable, If PP bags are not collected properly after plantation, non degradable PP bags may create long term water logging.

Mitigation-BFD will ensure collection of the PP bags in a borrowpit at each site. The collected bags can be handed over to private sector for recycling. Although, use of polythene bag is banned in Bangladesh, BFD received permission from MOEF to use poly propylene bags of minimum 55 □n thickness o seed germination back in 2007. A copy of the exemption letter is attached in Annex H.

Responsibility

- The community will be trained by BFD and involved in the Afforestation Program
- BWDB will ensure and supervise implementation of the environmental management during implementation and operation
- BWDB can seek assistance of third party environment specialist/supervision consultant input for ensuring environmental impacts have been addressed adequately during implementation and maintenance

6.4 Potential cumulative impacts in the CEIP polder area

197. Since the coastal polders will be rehabilitated and improved in phase by phase, it is a concern that the improvement of one polder might have impacts on flooding or salinity pattern outside the polder. For instance, when considered individually, the raising and strengthening of embankments in a given polder to withstand higher storm surges will benefit the people inside the polder and has very little long term impact outside the polder. The higher embankment has an impact only during the rare occurrence of a storm surge affecting that particular polder (say once in 10 years or so), and that also for a day or two. Such events do not cause long term morphological change or salinity impacts except within polders that have been flooded. However, there is a related impact on storm surge levels outside the polder. If more and more polders are protected from storm surges by higher embankments, their cumulative effect would drive the storm surge levels even higher, and possibly further upstream along the river system. Preliminary analysing of the location and proposed design specification (including CC impacts) of first phase 17 polders shows that most of the polders **will not have significant impact on storm surge level and cumulative impact on other polders,** as they are located either on the bank of big river and sea or far from the coast on the northern side of the Sundarbans. Only few polders (39/2C, 41/1, 43/2C, 47/2) might have slight impact on increasing storm surge level and cumulative impact on other surrounding polders.

198. Nevertheless, as more polders will be protected in subsequent phases the design crest level would be driven higher. Thus it is important to look into the possible cumulative effect and residual impacts of rehabilitation of coastal polders.

199. Furthermore, due to improved drainage system and flood protection, living standard of people will be high, more agriculture practices and industrialisation are expected. Therefore, water pollution by chemical fertilizer, pesticides and industrial effluents can be foreseen to increase in the coastal area.

6.5 Socio-Economic Enhancement

200. The project will have a positive impact in preventing a substantial part of the people in the project area from becoming landless. All strata of the population will benefit from the protecting agricultural land, homesteads, markets, hospitals schools roads, irrigation systems etc. Increased agricultural production and the construction works of the project will generate more employment opportunities for the poor and landless. To maximize the benefit the contractor is required to recruit local laborers.

Chapter 7 Environmental Management System

7.1 Introduction

201. The Environmental Management System (EMS) establishes the criteria to identify the adequacy of the Environmental Assessment and the processes involved, their sequence to conduct the EA studies for the rehabilitation and improvement of the polders system and afforestation including their legal requirement and implications. Comprehending the level of EA will help the CEIP in assessing the requirement of external agency in the form of consultancy services and also the stage of such requirement, like Design Consultant at planning and design stages and Construction Supervision Consultant (CS) at construction stage etc.

202. Identification of Project Influence Area is the first step of the Environmental Management. The project influence area spreads over four levels to justifiably defining the safeguard boundaries. The four tiers of project influence area are (i) immediate area of impacts (footprint) (ii) direct project influence, where project is key impact factor (iii) area where direct project impact is less intensive and (iv) induced, indirect (or perceived impacts), often reputation risk. The proponent needs to identify the impact zones clearly during project location identification as the first step of environmental assessment. The baseline analysis and impacts identification should be carried out in the direct and indirect impact zones. The project area of influence should also consider all its ancillary aspects. Potential for cumulative impacts needs to be considered both in "direct" and "indirect" areas of influence. However, perceived impacts and associated potential for reputational risk need to be considered as appropriate but should not dictate the boundaries of EIA.

7.2 General Principles of the CEIP

203. The proposed CEIP project aims at improving the performance of coastal polders through reduce drainage congestion and vulnerability to tidal/ storm surge taking into account the impact of climate change over a period of 25-30 years. Vulnerable coastal communities and their economy will highly benefit from this project. Due to the nature of proposed interventions under CEIP project and potential environmental impacts, the project falls under 'Red' category according to ECR, 1997 and also falls under "Category A' as per the World Bank Operation Policy 4.01, which requires proper environmental impact assessment and implementation of environmental management plan. Therefore, the EMF is prepared based on the following principles that can lead the planning and implementation of the project activities.

- The Project Director of BWDB is responsible for the compliance with national policies, regulations and World Bank Operational Policies and Guidelines, as mentioned in this EMF report. The EMF will serve as the basis for ensuring the compliance.

- BWDB is responsible for obtaining environmental clearance from DOE, local government agencies and World Bank as required.

- IEE and EMP will be prepared for each polder.

- Planning and design of the improvement work should ensure minimal cumulative impacts inside and outside the polders.

- Environmentally Sensitive areas, cultural sites, restricted or disputed lands should be taken care of with appropriate mitigation or compensation measures during implementation of the sub-projects.

- Participation of stakeholders (especially local community) should be ensured by BWDB in planning, implementation and monitoring of each sub-project.

- BWDB will ensure appropriate institutional set up for implementing environmental management plan and inter-agency coordination.

- Contractor will ensure provision of First Aid Kit at camp site with proper drinking water and sanitation facilities. Worker‘s health and safety measures shall be ensured and use of personal protective equipment shall be at place.

- BWDB will undertake public disclosure about the project interventions and potential impacts.

7.3 Environmental Assessment & Management Process of CEIP

- The environment consultant will perform the environmental screening at each polder.
- Environment consultant will ensure IEE and if noticeable environmental impact is observed, will develop the ToR for conducting an EIA of all polders.
- BWDB will share the IEE report and the EIA ToR with DoE and DoE will provide Site Clearance.
- Independent Consultant will review and clear screening and environmental assessment reports.
- BWDB will conduct verification of some screening and assessment.
- Design consultant will ensure that environmental considerations are given sufficient attention, weight and influence over design decisions of realignment, construction of coastal polders, introducing hydraulic structure and site selection for afforesatation. To this end, Environment Consultant will carry out IEE or EIA with EMP for coastal polders based on screening criterion.
- Bid documents will be prepared by the design consultant and EMP implementation should be done by Contractor.
- Coastal Embankment Improvement Program works will be supervised by management consultant and BWDB.
- All the activities of CEIP including coastal embankment and hydraulic structure construction, reconstruction and afforestation will follow existing Environmental Code of Practices (ECP) prepared under CEIP.
- The project will ensure that environmental assessment addresses all potential environmental direct and indirect impacts of the sub-project throughout its life: pre-construction, construction and operation stages and mitigation measures have been taken for it.
- The Environmental Assessment & Management Process for CEIP is presented in Figure 7.1.

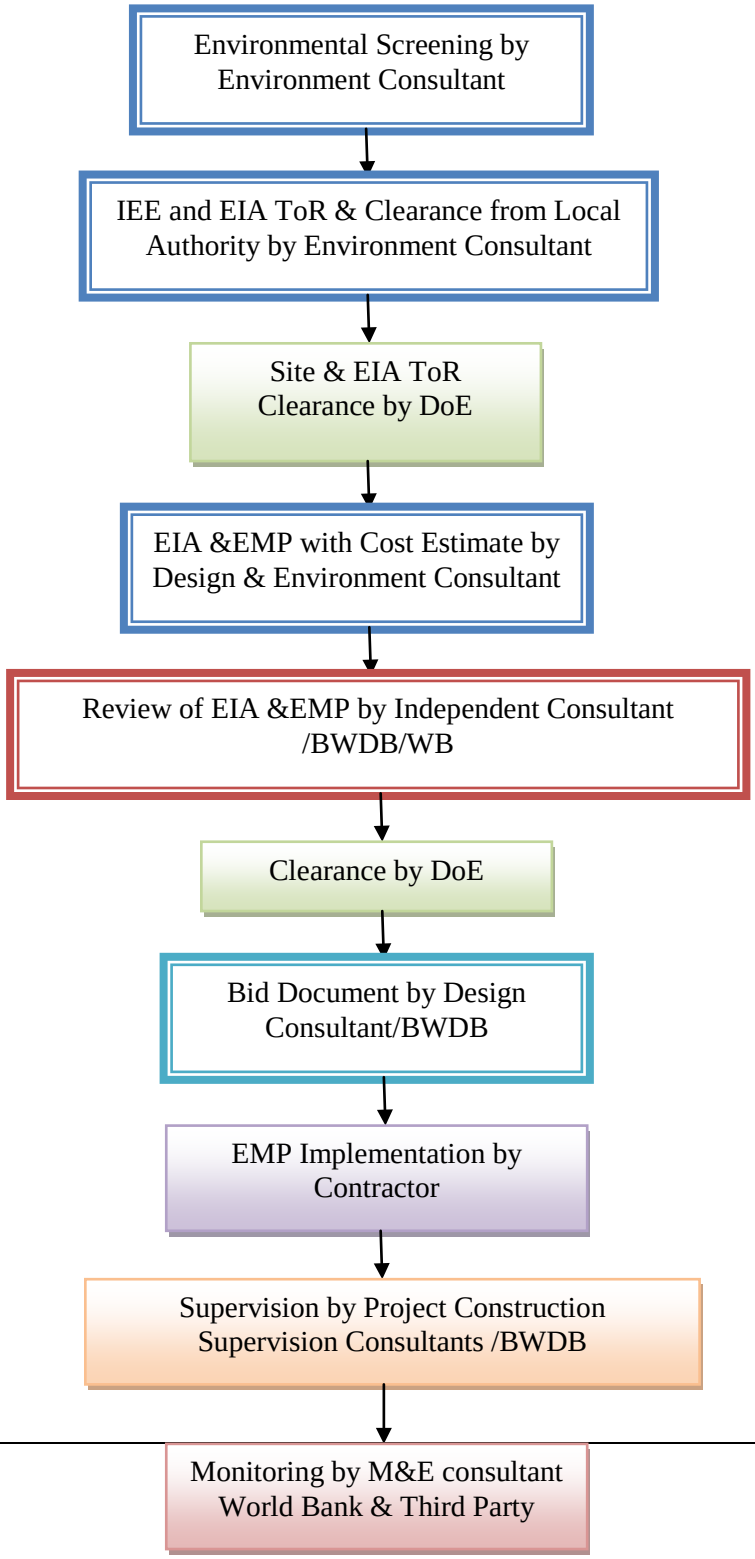

Environmental Screening by Environment Consultant
IEE and EIA ToR & Clearance from Local Authority by Environment Consultant
Site & EIA ToR Clearance by DoE
EIA &EMP with Cost Estimate by Design & Environment Consultant
Review of EIA &EMP by Independent Consultant /BWDB/WB
Clearance by DoE
Bid Document by Design Consultant/BWDB
EMP Implementation by Contractor
Supervision by Project Construction Supervision Consultants /BWDB
Monitoring by M&E consultant World Bank & Third Party

Figure 7-1Environmental Assessment & Management Process for CEIP

7.4 Classification of Environmental Assessment

7.4.1 Environmental Screening

204. Environmental screening is essential to gather information on existing baseline status and to assess potential environmental impacts of the CEIP project interventions. Environmental screening identifies the consequence of the proposed projects in broader sense based on similar project experiences, stakeholder's perceptions and expert judgment, without having very much detailed investigation. Critical issues are also identified through the screening which needs detailed investigation. Based on the extent of environmental impact obtained from the environmental screening, the decision for further environment impact assessment will be taken.

205. Environmental screening is usually carried out with the help of simple matrix that includes a set of check list to identify the baseline status and proposed potential impacts of the project intervention. Based on an extensive literature review and expert consultation, a screening matrix has been developed for sub-projects under CEIP (Appendix – 6 for Rehabilitation of Coastal Polders and Appendix -7 for Afforestation). Members of environmental assessment team will use this matrix for collecting information through site visit, interview/ consultation with stakeholders, focus group discussion in the project site.

206. During environmental screening, if it is found that the sub-project may create major irreversible environmental damage or may violate an existing environmental rule or regulation, the sub-project will be rejected. For instance, any sub-project that may encroach into an ecologically critical area or a national/ global heritage site will be rejected. BWBD must confirm the findings of the environmental screening carried out by the field staffs or consultants. Moreover, alternative project designs and/or operation will be considered and the environmental impact will be assessed to make the project more environment friendly. The environmental screening process will be followed before IEE study of sub-projects.

7.4.2 Initial Environmental Examination

207. The IEE study should be conducted for each sub-project under CEIP following the 'Guideline for Environmental Assessment of Water Management Projects (WARPO, 2005) and the Environmental Assessment requirements of World Bank (WB). The **purpose** of the IEE is three fold:

(i) to obtain for Site Clearance from DoE;
(ii) provide the ToR for the EIA study; and
(iii) continue consultations with project stakeholders.

The **Process** of IEE is briefly outlined below

(a) Analysis of the Project Components: All the components of the CEIP, like construction works and resettlements, will be examined thoroughly which will in fact guide the development of checklist for reconnaissance survey.

(b) Preparation of Checklist: A comprehensive checklist of potential environmental components likely to be impacted need to be prepared based on the guidelines of different agencies such as DOE, World Bank, WARPO, and ADB.

(c) Initial Screening/ Survey: Not all the parameters selected in previous step may be significant for the project; hence the first activity will be to shorten this list to concentrate on significant effects. Data should be collected from all possible secondary sources, if available, and conduct an environmental reconnaissance with the relevant checklist in hand to identify and delineate the significant effects of the project and eliminate the others from further considerations. Public consultation will play an important role in initial screening.

(d) Analysis of alternatives: Alternative site and technological design should be analyzed for the proposed project interventions considering environmental, social, and technological criteria.

(e) Identification and Scaling of Impacts: All the potential short and long term environmental impacts should be identified. The impacts can be graded qualitatively (e.g. high, medium, low) in order to identify major impacts and relevant components. In addition, cumulative and residual impacts of the project interventions need to be clearly addressed.

(f) Identification of Enhancement and Mitigating Measures: From literature survey and applying expert judgment and based on assessed impacts, a list of possible enhancement and mitigating measures for beneficial and adverse effects respectively should be prepared.

(g) Preparation Environmental Management and Monitoring Plan: Environmental management plan for the proposed project should be prepared mentioning the impact mitigation/ enhancement measures with institutional responsibilities. Also, environmental monitoring plan should be prepared that will include monitoring parameters, frequency, method and responsible agencies.

(h) Recommendations on the need of EIA study: The IEE study should recommend as to whether a full-scale EIA study is needed or not.

(i) Preparation of ToR for EIA: Based on the IEE findings, a detailed ToR for subsequent EIA study should be prepared. The ToR will specially focus on the adverse impacts of high magnitude. Attention should also be given to cumulative and residual impacts.

208. All the findings of the IEE study should be presented in a report, as per outline given in Appendix – 8. ToR for conducting IEE study is given in Appendix – 8.

7.4.3 Environmental Impact Assessment

209. Environmental Impact Assessment is a planning tool now generally accepted as an integral component of sound decision making. The purpose of EIA is to give the environment its due importance in the decision making process by clearly evaluating the environmental consequences of the proposed study before action is taken. Early identification and characterization of critical environmental impacts allows the public and the government to form a view about the environmental acceptability of a proposed development project and what conditions should apply to mitigate or minimize those risks and impacts.
In the preparation phase, the EIA shall achieve the following objectives:

- To establish the environmental baseline in the study area, and to identify any significant environmental issue;
- To assess these impacts and provide for measures to address the adverse impacts by the provision of the requisite avoidance, mitigation and compensation measures;
- To integrate the environmental issues in the project planning and design;
- To develop appropriate management plans for implementing, monitoring and reporting of the environmental mitigation and enhancement measures suggested.

7.5 Environmental Assessment Process

Stage 1: Planning

210. Soon after the commencement of planning and design process, based on desk study, reconnaissance survey and experience of earlier projects, detailed methodology and schedule should be prepared for the effective and timely execution of the Environmental Assessment.

Desk Study: To collect the secondary information and checking out the methodology for carrying out the EA study and fixing of responsibilities of the EA team members for preparing a complete, addressing all issues, Environmental Management Plan.

Reconnaissance survey: To collect the first hand information about the project area and develop a perspective of the entire team and revise the methodology and work program.

Experience from Earlier Project:

- **Focus on the main issues:** It is important that the EA does not try to cover too many topics in too much detail. Effective scoping can save both time and money by focusing the EA studies on the key issues.
- **EA requires the formation of a multidisciplinary team and the leadership of a strong EA coordinator.** The range of effects considered in the EA requires the skills of CEIP mix of technical experts to be employed on an assessment team, lead by a Team Leader/EMU. It is important to involve the right people (e.g., scientists, engineers, policymakers, government 0prepresentatives, representatives of public interest groups and the local community) and agencies (e.g., the developer, the aid agency, regulatory authorities and politicians) in the EA process. Selection will be made through consultation at different stages.
- **Make maximum use of existing information before engaging expensive field studies.**
- **Cumulative impact of the project.** Based on reconnaissance survey and desk study and modeling, project influence area will be fialized.
- **Present clear and appropriate options for mitigation of impacts and for sound environmental management.** Mitigation is an integral part of impacts assessment. Application of appropriate mitigation can eliminate or reduce negative impacts, and improve the net overall environmental performance of a project. Hence public consent, practical viability will be considered in proposing the mitigation measures.
- **Post-EIA audits and monitoring programs are essential to ensuring that EA commitments are carried out and that future EA improve.** An effective monitoring plan will be proposed in consultation with the client and the World Bank. Proper budgeting will be ensured for smooth functioning of monitoring plan proposed.

Stage 2: Scoping

211. Scoping will identifies which of the activities has a potential to interact with the environment. Scoping will be conducted early in the EA process so that a focus on the priority issues (i.e. those that

have the greatest potential to affect the natural and/or environment) can be established for the rest of the EA process. Key elements/inputs to the scoping exercise will be as follows:

- Gathering and reviewing existing environmental data like atmosphere, climate, topography, congestion area, alternative requirement, land use pattern, hydrology and drainage pattern, major river and waterways, religious, cultural and archaeological sites and sensitive areas.
- Identifying project stakeholders; including PAPs, Government and non-government agencies (utilities), Bangladesh Water Development Board, Forest Department, Agricultural Department, Department of Environment (DOE) etc.
- Assemble and review relevant legislative requirements, environmental standards and guidelines (national and international) associated with the proposed development as well as the World Bank‘s operational policies and standards.
- Gathering existing information sources and local knowledge;
- Informing stakeholders of the project and its objectives and get input on the EA;
- Identifying the key environmental concerns (community and scientific) related to a project and the relative importance of issues;
- Defining/preparing the EA work program, including a plan for public and stakeholder involvement;
- Carrying out monitoring of natural environment including air, water, soil, noise etc.
- Defining the range of project alternatives to be considered.
- Obtaining agreement/consensus on the methods and techniques to be used in EA studies and document preparation;
- Determining/freezing the spatial and temporal boundaries for the EA studies.

212. Focus of scoping will be on the collection and analysis of pertinent data and the assessment of significant environmental attributes. The end result will be a work program which is well focused and cost-effective. The following issues will be addressed through scoping, but will not be limited to.

- To improve the quality of EA information by focusing scientific efforts and EA analysis on truly significant issues;
- To ensure environmental concerns identified and incorporated early in the project planning process, at the same time as cost and design factors are considered;
- To ensure research efforts are not wasted on insignificant issues, rather focused on core issues.
- Reducing the likelihood of overlooking important issues;
- Thinning the chance of prolonged delays and conflicts later in the EA process by engaging stakeholders in a constructive participatory process early in the EA process.

Stage 3: Environmental Impact Assessment

213. The EIA of the selected polders should be conducted following the Guideline for Environmental Assessment of Water Management Projects (WARPO, 2005) and the Environmental Assessment requirements of World Bank . After conducting IEE, the EIA should be conducted, as per TOR for EIA suggested in IEE study and approved by DOE. The process of EIA study is briefly described below.

a. Analysis of the Project Design and Components: All the components of the CEIP and design specifications will be analyzed to get insight of the project interventions. This will guide detail environmental baseline survey and particular investigations.

b. Data collection on Environmental and social baseline: Environmental and social baseline condition of the proposed sub-projects should be collected through several field visits, surveys and intensive consultation with local people. Detailed data on land resources, water resources, agriculture, fisheries, ecosystems and socio-economic condition should be collected. Intensive consultation with the stakeholders should be carried out to obtain their perceptions on the proposed interventions and the possible impacts.

- **Primary data/monitoring** to define characteristics of the existing environmental condition including soil, water, air, noise, land use, cultural properties and flora and fauna.
  - Monitoring to be carried at critical locations;
  - Identification of residential, commercial, industrial and forest areas for monitoring;
  - Air and noise monitoring at significant location, major settlements, mosque, school and hospitals etc.;
  - Water monitoring at river/canal/pond and ground water sources near major settlements;
  - Soil monitoring at major settlements, near surface water bodies;
  - Tree inventory to be carried out, in consultation with the Forest Department; and
  - Inventory of cultural, religious and archeological sites will be done along with measurements, details and photographs, consultation will be done for gathering public opinion.

- **Secondary data** to define meteorological, geology, seismicity, quarries, borrow areas, disposal sites etc.
  - Details of quarry and borrow areas to be used will be collected (photographs, measurements and public opinion) and a comprehensive plan for extracting material will be prepared.
  - Meteorological data from Bangladesh Meteorological Department (BMD), topographic sheets and maps from Survey of Bangladesh (SOB), geological and soil data from Bangladesh Soil Resources Institute, Seismic data from Space Research and Remote Sensing Organization (SPARSO).

- **Social data** including ownership pattern, identification of tribals, vulnerable social groups, land estimates etc.

c. Project Area of Influence: At the outset of the study, the Project area of influence (or Project area for short) will be broadly demarcated. This included the area inside the polder where most of the Project interventions would take place, area immediately outside the polder embankments (this area could be used for staging of construction works, material stockpiling, and/or earth borrowing), access routes for the polder, borrow as well as spoil disposal areas if located outside the polder, and labor camps/contractor facilities if located outside the polder. The bounding water bodies on the surrounding of the river will be included in the Project Area of Influence.

d. Scoping and bounding: Important Environmental and Social Components (IESCs), likely to be impacted directly and indirectly by the project interventions, selected at the IEE stage will be revisited for finalizing their selection based on detailed information on the proposed interventions. A bounding exercise will be carried out to delineate area likely to be impacted by polder

e. Major Field investigations: At this stage, detailed field survey (social and environmental) will be carried out to obtain information on the possible impact of the interventions on the IESCs.

f. Assessment of Environmental and social Impacts: The impacts of the proposed CEIP project on the environmental and social components will be identified through consultation with experts and local community. The impacts will be analyzed and graded qualitatively (e.g. high, medium, low) in order to identify the major impacts. The future-without-project (FWOP) condition will be generated through trend analysis using information collected. The future-with-project (FWIP) condition will be predicted using professional judgment of the multi-disciplinary team members based on information collected. Difference between the two (FWIP-FWOP) conditions will be taken as impact of the proposed interventions. Moreover, cumulative impacts of the project inside or outside the project area will be analyzed. Possible mitigation measures for alternatives of the project will be identified in this stage. For true impacts prediction following questionnaire will be attempted to answer:

- How will a particular project activity give rise to an impact?
- How likely is it that an impact will occur?
- What will be the consequence of each impact?
- What will be the spatial and temporal extent of each impact?

g. Evaluation of impacts: Impact assessed on different IESCs will be evaluated assigning score ranging from 1 to 10 for both positive (+) and negative (-) impacts considering magnitude, immediacy, reversibility and sustainability.

Analysis of Alternatives: Since the existing structures of coastal polders will be improved under CEIP project, alternative options for designing the project interventions will be analyzed. The potential impacts of alternative design of structure will be evaluated.

- With or without the project.
- Analysis criteria to include environmental, social, technical/design and economic options.
- Alignment options within existing positions
- Suitable locations of Hydraulic Structure
- Other engineering alternatives
- Site and Selection of Plant Species

h. Preparation of environmental management plan: The EMP will be prepared suggesting mitigation measures for minimizing the effect of the negative impacts, compensation measures for the negative impacts which cannot be mitigated, enhancement measures for increasing the benefits of the positive impacts, contingency plan for taking care of natural hazards and accidental events. An environmental monitoring plan will also be suggested in the EMP. Each component of the EMP will be divided into pre-construction, during construction, post construction and operation and maintenance phases. Responsibilities of the institutions in the implementation of the EMP will be suggested to ensure efficient utilization of all the parties involved.

i. EIA Report Preparation: All the findings would be presented in the EIA reports as per outline given in Appendix – 9. A preliminary TOR for EIA is given in **Appendix – 9**.

Stage 4: Public Consultation

214. "Public consultation" refers to the process by which the concerns of local affected persons and others who have plausible stake in the environmental impacts of the project or activity are ascertained

with a view to taking into account all the material concerns in the project or activity design as appropriate. All Category 'A' projects or activities shall undertake public consultation. The key points of public consultation are given below:

Stakeholder Consultation at all Stages of Project

- Identification of primary and secondary stakeholders.

- Primary stakeholders include people having direct impact.

- Secondary stakeholders include village representatives, women's group, voluntary organizations NGOs, field level officers and staff, other government officials.

- Structured Consultation

- Consultation at Village Level
- Consultation at Upazila and District Level
- Consultation at Divisional level

Consultation at Village Level

- Along with preliminary inventory and survey information dissemination will be done along each polder canvassing about the project. Date and venue for detailed consultation will be fixed.
- Pictorial method (Pamphlet) will be adopted to explain proposed improvements and possible environmental impact in the concerned villages.
- Public consensus would try to be arrived for and mitigation proposed.
- Public suggestion and graveness will be addressed at appropriate level.

Consultation at Upazila and District Level

- Consultation with officers of Agricultural Department, Forest Department, Soil Department, Fisheries Department, Department of Public Health Engineering (DPHE), etc.
- Consultation with the elected representatives and other stakeholders.

Consultation at Divisional level

- Consultation with senior department officers, like DOE office, District Commissioner Offices, Settlement offices etc. and mechanism of regulatory clearance, utility shifting, land acquisition etc.

215. After completion of the public consultation, the design consultant shall address all the material environmental concerns expressed during this process, and make appropriate changes in the draft EIA and EMP. The final EIA report, so prepared, shall be submitted by the client to the concerned regulatory authority for appraisal.

7.6 Selection of Important Environmental and social Components (IESCs), scoping and bounding

216. Environmental and social components likely to be impacted by the project interventions are termed as Important Environmental and social Components (IESCs). IESCs have been selected based on the rationale of impact for each component during pre-construction, construction and post-construction stages. A scoping process was followed for selecting IESCs which are likely to be impacted by the proposed interventions of CEIP. Scoping was done in two stages. Individual professionals of EA study team made a preliminary list of the components pertaining to their disciplines, which could be impacted by the project. The second stage included scoping sessions where stakeholder perceptions have been obtained about those environmental and social components. Professional judgment of the EA team

members as well as the stakeholder opinions obtained in the scoping sessions was considered in selecting the IESCs. Area likely to be impacted by the proposed interventions of the CEIP project was delineated in consultation with the feasibility study team members in addition to feed back received from the local people during baseline consultation and stakeholder consultation meeting. The entire area influenced by proposed sub-projects under CEIP project was considered as the potential area to be impacted.

Table 7-1 Impact of Project Activity on IESC

IESC	Pre-construction/Initial Phase					Construction/Implementation Phase					Operation Phase	Indirect effect of operation of induced development
	Land Acquisition	**Removal of structures**	**Removal of trees and vegetation**	**Realignment of Polder**	**Site Selection for Afforestation**	**Excavation/ Earthwork**	**Vehicle & machine operation & maintenance**	**River Bank protection**	**Dredging**	**Sanitation & waste (labor camps)**	**Project operation**	
Air		Dust generation during dismantling	Reduced buffering of air and noise pollution, hotter, drier microclimate			Fugitive Dust generation	PMs, NOx, SOx	Dust pollution		Odour / smoke	SPMs, NOx, SOx	Other pollution
Soil/ Land					Change in land scape	Landscape will be degraded If top soil is removed land fertility will be decreased Disposal of dredged material at improper site Collection of soil material for earthen work from surrounding areas may create destruction of near by structures, erosion from collection site.					Water logging	Fertility may increase due to TRM
Agriculture	Loss of agricultural land			Loss of agricultural land	Loss of agricultural land	Top soil removal Borrow pit may induce nuisance plant growth which will effect agriculture production					Crop damage area will be decreased Improper use of hydraulic structure operation may lead to salinity increase If Tidal River Management is	Irrigation area in dry season will increase Agriculture loss due to TRM Due to TRM

IESC	Pre-construction/Initial Phase					Construction/Implementation Phase					Operation Phase	Indirect effect of operation of induced development
	Land Acquisition	Removal of structures	Removal of trees and vegetation	Realignment of Polder	Site Selection for Afforestation	Excavation/ Earthwork	Vehicle & machine operation & maintenance	River Bank protection	Dredging	Sanitation & waste (labor camps)	Project operation	
											traduced flooding in the low lying areas	salty and Brackish water from the Bay getting into agriculture land will have major negative impacts on rice cultivation and other crops which require salt free water
Water resource & Hydrology		Siltation due to loose earth	Siltation due to loose earth	Encroaching water bodies	Soil erosion due to wrong site selection	Siltation due to loose earth	Contamination by fuel and lubricants	Siltation due to loose earth, soil erosion	The suspended sediment load and turbidity of a river are increased	Contamination from wastes	-Soil erosion and sedimentation mismanagement Eutrophication in the borrow pit May create backwater flow due to the embankment and improper use of hydraulic structure Water logging due to TRM and improper use of hydraulic structure	Increased contamination of surface water
Fisheries	Encroachment of fish habitat			Encroachment of fish habitat		Increased siltation in the water bodies			Substrate removal will inevitably affect		Hudraulic Structures will create barrier for fish migration	Reduction in fish species

IESC	Pre-construction/Initial Phase					Construction/Implementation Phase					Operation Phase	Indirect effect of operation of induced development
	Land Acquisition	**Removal of structures**	**Removal of trees and vegetation**	**Realignment of Polder**	**Site Selection for Afforestation**	**Excavation/ Earthwork**	**Vehicle & machine operation & maintenance**	**River Bank protection**	**Dredging**	**Sanitation & waste (labor camps)**	**Project operation**	
									spawning. Suspended sediment in the water affects the respiratory system of fish. Growth may also be affected since food supply and feeding success are reduced in the turbid conditions			
Ecosystem			Loss of Biomass	Encroaching habitat		Eutrophication	Contaminating water	Barrier on free movement	Loss and alteration of natural habitat		Improper selection of plant will introduce nuisance plant	Change of Ecology
Noise							Increase			Increase	Increase	Increase
Socio-economic	Displacement of people psychological impact on people loss of livelihood	Effect on cultural set ups		Displacement of people		Borrow pits can be mosquito breeding place	Damage of local roads due to movement of heavy axle loads			Increase in communicable diseases	Water logging will act as mosquito breeding place	TRM will greatly impact the livelihood of the people in the low lying area every year

- **Assessment Methodology**

217. The assessment of effects and identification of residual impacts takes account of any incorporated mitigation measures adopted due to any potential impact of Project activities, and will be largely dependent on the extent and duration of change, the number of people or size of the resource affected and their sensitivity to the change. Potential impacts can be both negative and positive (beneficial), and the methodology defined below will be applied to define both beneficial and adverse potential impacts.

218. The criteria for determining significance are generally specific for each environmental and social aspect but generally the magnitude of each potential impact is defined along with the sensitivity of the receptor. Generic criteria for defining magnitude and sensitivity used for the Project are summarized below.

Magnitude

219. The assessment of magnitude has been undertaken in two steps. Firstly the key issues associated with the Project are categorized as beneficial or adverse. Secondly, potential impacts have been categorized as major, moderate, minor or negligible based on consideration of the parameters such as:

- Duration of the potential impact;
- Spatial extent of the potential impact;
- Reversibility;
- Likelihood; and
- Legal standards and established professional criteria.

220. The magnitude of potential impacts of the Project has generally been identified according to the categories outlined in Table 7.2.

Table 7.2: Parameters for Determining Magnitude

Parameter	Major	Moderate	Minor	Negligible/Nil
Duration of potential impact	Long term (more than 35 years)	Medium Term Lifespan of the project (5 to 15 years)	Less than project lifespan	Temporary with no detectable potential impact
Spatial extent of the potential impact	Widespread far beyond project boundaries	Beyond immediate project components, site boundaries or local area	Within project boundary	Specific location within project component or site boundaries with no detectable potential impact
Reversibility of potential impacts	Potential impact is effectively permanent, requiring considerable intervention to return to baseline	Baseline requires a year or so with some interventions to return to baseline	Baseline returns naturally or with limited intervention within a few months	Baseline remains constant
Legal standards and established professional criteria	Breaches national standards and or international guidelines/obligations	Complies with limits given in national standards but breaches international lender guidelines in one or more parameters	Meets minimum national standard limits or international guidelines	Not applicable
Likelihood of potential impacts occurring	Occurs under typical operating or construction conditions	Occurs under worst case (negative impact) or best case (positive impact)	Occurs under abnormal, exceptional or emergency	Unlikely to occur

Parameter	Major	Moderate	Minor	Negligible/Nil
	(Certain)	operating conditions (Likely)	conditions (occasional)	

Sensitivity

221. The sensitivity of a receptor has been determined based on review of the population (including proximity / numbers / vulnerability) and presence of features on the site or the surrounding area. Criteria for determining receptor sensitivity of the Project's potential impacts are outlined in Table 7.3.

Table 7.3: Criteria for Determining Sensitivity

Sensitivity Determination	Definition
Very High	Vulnerable receptor with little or no capacity to absorb proposed changes or minimal opportunities for mitigation.
High	Vulnerable receptor with little or no capacity to absorb proposed changes or limited opportunities for mitigation.
Medium	Vulnerable receptor with some capacity to absorb proposed changes or moderate opportunities for mitigation
Low / Negligible	Vulnerable receptor with good capacity to absorb proposed changes or/and good opportunities for mitigation

Assigning Significance

222. Following the assessment of magnitude, the quality and sensitivity of the receiving environment or potential receptor has been determined and the significance of each potential impact established using the potential impact significance matrix shown in Table 7.4.

Table 7.4: Assessment of Potential Impact Significance

Magnitude of Potential impact	Sensitivity of Receptors			
	Very High	High	Medium	Low / Negligible
Major	Critical	Major	Moderate	Negligible
Moderate	Major	Major	Moderate	Negligible
Minor	Moderate	Moderate	Low	Negligible
Negligible	Negligible	Negligible	Negligible	Negligible

7.7 Environmental Management Plan (EMP)

7.7.1 Guideline Principles of EMP

223. Efforts should be made and practiced to mitigate and minimize negative environmental impact from the project design phase of CEIP. The possible impacts from the project activities have been identified in Chapter 6 and reflected in the proposed EMP. The following EMP will be followed for the identified environmental impacts during pre-construction, construction and O&M stages due to implementation of CEIP project. The key steps of the methodology (MRDI, 2011) includes:

- Deriving mitigation/protection measures for identified impacts for each of the Project activity and environmental component;

- Recommend mitigation, compensation and enhancement measures for each identified impacts and risks;
- Developing a mechanism for monitoring the proposed mitigation measures,
- Estimating budget requirements for implementation mitigation and monitoring measures, and
- Identifying responsibilities of various agencies involved in the Project for implementation and monitoring of mitigation measures

224. The methodology followed for preparing the EMP is presented in Figure 7.2.

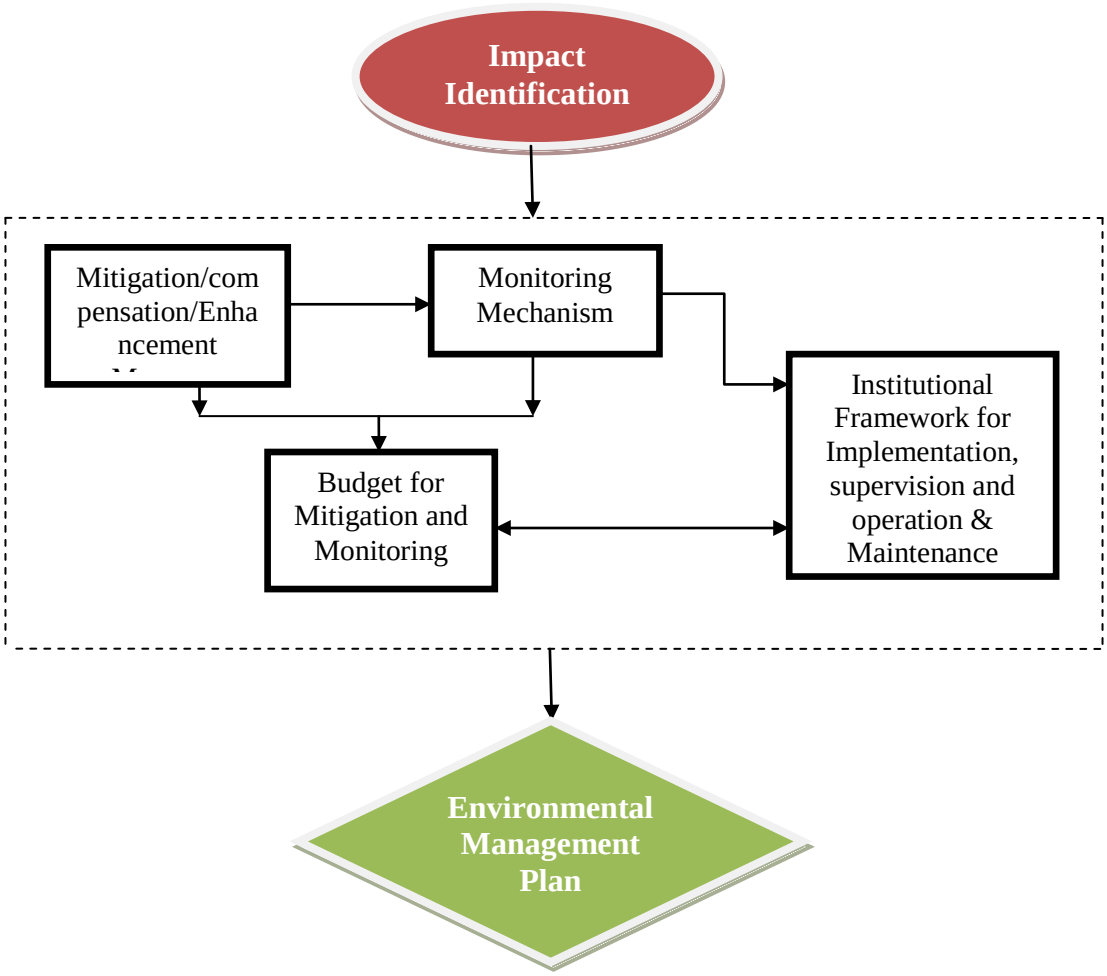


Figure 7-2 Framework for Preparation of EMP during Construction and O&M (MRDI, 2011)

The EMP should be included in all the bid documents of the Project and will become a part of the civil works contract. The strict implementation of the EMP and project management's strict enforcement of the adequate construction practices and standards will greatly reduce the negative impacts of the Project.

7.7.2 Mitigation Measures

225. Mitigation is an integral part of impact evaluation. Where mitigation is deemed appropriate, a proponent should strive to act upon effects, in the following order of priority, to:

- Eliminate or avoid adverse impacts, where reasonably achievable.
- Reduce adverse impacts to the lowest reasonably achievable level.

- Regulate adverse impacts to an acceptable level, or to an acceptable time period.
- Create other beneficial impacts to partially or fully substitute for, or counter-balance, adverse effects.

226. Mitigation measures should be considered starting with Environmental Assessment process. It is important therefore, that there is good integration between the EIA team and project design engineers. Project specific environmental construction guidelines should be developed. These guidelines should specify precautions and mitigation measures for construction activities, and to be included with the EMP. Good Environmental Construction guidelines has been compiled in Appendix 10.

227. Impacts identified severe in consequence category and or likelihood category will be further analyzed to identify additional mitigation measures that are potentially available to eliminate or reduce the predicted level of impact. Potential mitigation measures will include:

- habitat compensation program
- species specific management program
- engineering design solutions
- alternative approaches and methods to achieving an activity‘s objective
- stakeholders participation in finalizing mitigation measures
- construction practice, including labor welfare measures.
- operational control procedures
- management systems

228. Based on the past experience, a generic Mitigation Measures for EMP has been presented in Table 7.4 below for reference. This can be used as a reference material for comprehending the scope of the EMP.

Table 7-5 Generic Mitgation/Compensation Meaqsures/Guideline

Parameter/Activities	Mitigation/Compensation Measure/Guideline
ECoP 1: Soil/ Land Management	
Sources of Material for Earthwork	• During design the segment wise soil requirement and location of the sources of soil for earthwork for each polder construction/rehabilitation should be identified. • Selection of Borrow Areas for earthen material collection. • No objection from land owner/Revenue authorities as applicable • Contractor shall ensure that borrow materials used for embankment filling is free of pollutants • Disposal of excess soil should be done at site with no objection from DoE and local authority
Borrowing of Earth	**Borrow Area Selection** Borrowing close to the toe line on any part of the embankment is prohibited. Earth available from dredging as per design, may be used as embankment material (if necessary and applicable), subject to approval of the Engineer, with respect to acceptability of material. Borrowing to be avoided on the following areas: • Lands close to toe line and within 0.5 km from toeline. • Irrigated agricultural lands (In case of necessity for borrowing from such lands, the topsoil shall be preserved in stockpiles. • Grazing land. • Lands within 1km of settlements. • Environmentally sensitive areas such as reserve forests, protected forests, sanctuary, wetlands. Also, a distance of 500 m should be maintained from such areas. • Unstable side-hills. • Water-bodies (only if permitted by the local authority, and with specific pre-approved redevelopment plans by the concerned authority and engineer-in-charge) • Streams and seepage areas. • Areas supporting rare plant/ animal species.

Parameter/Activities	Mitigation/Compensation Measure/Guideline
	Documentation of Borrow Pit The contractor must ensure that following data base must be documented for each identified borrow areas before commencing the borrowing activity that provide the basis of the redevelopment plan. • Chainage along with offset distance; • Area (Sq.m); • Photograph and plan of the borrow area from allsides; • Type of access/width/kutcha/pucca etc. from theroadway; • Soil type, Slope/drainage characteristics; • Water table of the area or identify from the nearest well, etc; • Existing land use, for example barren / agricultural /grazing land; • Location/name/population of the nearest settlement from borrow area; • Quantity excavated (likely and actual) and its use; • Copy of agreement with owner/government; and • Community facility in the vicinity of borrow pit. • Rehabilitation certificate from the land owner along with at least four photograph of the rehabilitated site from different angles.
Excavation operation and Management of Excavated Material	To minimize the adverse impact during excavation of material following measures are need to be undertaken: • Adequate drainage system shall be provided to the excavated area • At the stockpiling locations, the Contractor shall construct sediment barriers to prevent the erosion of excavated material due to runoff. The followings precautions shall be undertaken during quarry operations. • Overburden shall be removed. • During excavation slopes shall be flatter than 20 degrees to prevent their sliding. • In case of blasting, the procedure and safety measures shall be taken as per DOE guidelines. • The Contractor shall ensure that all workers related safety measures shall be taken. • The Contractor shall ensure maintenance of crushers regularly as per manufacturer‘s recommendation. • During transportation of the material, measures shall be taken to minimize the generation of dust and to prevent accidents.
Handling Dredged Material from River Dredging	• Deposition of dredged material should be away from the channel edge to limit damage to streamside habitats. This also allows a degree of flooding to occur on the floodplain, thereby creating opportunities for wet grassland, scrub/wet woodland, wetlands and seasonally grazed rough grass. • Where possible biotechnical engineering, for example geotextiles, may be used to help stabilize the material and aid re-colonization. • Other possibilities include: drying and spreading the spoil over adjacent land, which can improve soil fertility in some cases, but may also smother important flora and habitats; excavating a trench and infilling it with spoil, thus minimizing disturbance to agriculture and the local environment; dumping off-site is possible but expensive, using spoil to create artificial wetlands.
Contamination of soil by fuel and lubrication	
ECoP 2: Water Resource & Hydrology Management	
Hazardous Waste Management	The contractor will minimize the generation of sediment, oil and grease, excess nutrients, organic matter, litter, debris and any form of waste (particularly petroleum and chemical wastes).
Ponding of water/water logging	• Do not allow ponding of water especially near the waste storage areas and construction camps • Discard all the storage containers that are capable of storing of water, after use or store them in inverted position

Parameter/Activities	Mitigation/Compensation Measure/Guideline
	• Reinstate relief and landscape • Monitor drainage pattern after high down pouring and recession flood • Connect water pockets to the nearest drainage structures/canals
Soil Erosion and siltation	The Contractor shall • Water the material stockpiles, access roads and bare soils on an as required basis to minimize dust. Increase the watering frequency during periods of high risk (e.g. high winds) • All the work sites (except permanently occupied by the road and supporting facilities) should be reinstated to its initial conditions (relief, topsoil, vegetation cover). • Ensure that roads used by construction vehicles are swept regularly to remove sediment
Dredging	• Disturbance can be minimized if mechanical excavators work from one bank. If the channel is too wide, the digger must work within the channel. Disruption can be minimized by diverting the river down one side of the channel and dredging the other side while it is 'dry'. Smaller plant equipment generally limits the level of impact on bank-side and in-stream habitats.
Construction activities in water bodies	• Protect water bodies from sediment loads by silt screen or bubble curtains or other barrier. • Do not discharge cement and water curing used for cement concrete directly into water courses and drainage inlets • Monitor the water quality in the runoff from the site or areas affected by dredge plumes, and improve work practices as necessary
ECoP 3: Air Management	
Construction vehicular traffic	The Contractor should • Fit vehicles with appropriate exhaust systems and emission control devices. Maintain these devices in good working condition. • Operate the vehicles in a fuel efficient manner • Cover haul vehicles carrying dusty materials (cement, borrow and quarry) moving outside the construction site • Impose speed limits on all vehicle movement at the worksite to reduce dust emissions • Control the movement of construction traffic • Water construction materials prior to loading and transport • Service all vehicles regularly to minimize emissions • Materials will be transported to site in off peak hours.
Construction activities	• Water the material stockpiles, access roads and bare soils on an as required basis to minimize the potential for environmental nuisance due to dust. • Increase the watering frequency during periods of high risk (e.g. high winds). • Stored materials such as excavated earth, dredged soil, gravel and sand shall be covered and confined to avoid their being wind-drifted • Minimize the extent and period of exposure of the bare surfaces • Reschedule earthwork activities or vegetation clearing activities, where practical, if necessary to avoid during periods of high wind and if visible dust is blowing off-site • Restore disturbed areas/side of the embankment as soon as practicable by plantation/vegetation/grass-turfing • Establish adequate locations for storage, mixing and loading of construction materials, in a way that dust dispersion is prevented because of such operations • Crushing of rocky and aggregate materials shall be wet-crushed, or performed with particle emission control systems
Odor from Construction labor Camps	• Construction worker‘s camp shall be located at least500 m away from the nearest habitation. • The waste disposal and sewerage system for the camp shall be properly designed, built and operated so that no odor is generated.
ECoP 3: Agriculture Management	
Loss of Top Soil	• Soil from fallow lands/ non-agricultural lands should be used in earthwork in embankments • Collect/strip top soil before earth filling and store and reuse it for final surfacing of embankment top and tree plantation/afforestation.

Parameter/Activities	Mitigation/Compensation Measure/Guideline
	• Strip the top soil to a depth of 15 cm and store in stock piles of height not exceeding 2m • Remove unwanted materials from top soil like grass, roots of trees and similar others • The stockpiles will be done in slopes of 2:1 to reduce surface runoff and enhance percolation through the mass of stored soil • Locate topsoil stockpiles in areas outside drainage lines and protect from erosion • Spread the topsoil to maintain the physico-chemical and biological activity of the soil. • The stored top soil will be utilized for covering all disturbed area and along the proposed plantation sites • Topsoil stockpiles will be monitored and should any adverse conditions be identified corrective actions will include: o Anaerobic conditions-turning the stockpile or creating ventilation holes through the stockpile; o Erosion – temporary protective silt fencing will be erected;
Soil salinity	• Use of duckweed will remove soil salinity • Flushing with pre-monsoon rain water will reduce soil salinity. • Saline tolerant crops need to be cultivated. • Environmentally and socially responsive shrimp farming e.g. shrimp-rice farming system is encouraged. • Increasing upland discharge of fresh water will push back ingress of saline water from the sea • Green manure application is promoted • Ground water abstraction for shrimp farming should be avoided.
ECoP 4: Noise Management	
Construction vehicular traffic	• Maintain all vehicles in order to keep it in good working order in accordance with manufactures maintenance procedures • Organize the loading and unloading of trucks, and handling operations for the purpose of minimizing construction noise at the work site.
Construction machinery	• Appropriately site all noise generating activities to avoid noise pollution to local residents • Maintain all equipment in order to keep it in good working order in accordance with manufactures maintenance procedures.
Construction activity	• Notify adjacent landholders/Schools prior any typical noise events outside of daylight hours • Employ best available work practices on-site to minimize occupational noise levels • Install temporary noise control barriers where appropriate • Plan activities on site and deliveries to and from site to minimize impact • Monitor and analyze noise and vibration results and adjust construction practices as required • Avoid working during 09:00pm to 06:00 am within 500m from residences.
ECoP 5: Ecology Management	
Flora	
Vegetation Clearance	• Tree felling should be performed upon preliminary notification to the relevant authority (District Forest Office, DoE). • Preparation of maps in GIS format, cadastral description of trees to be felled, marking, and supervision of Forest Department are necessary elements of the procedure. • Provide adequate knowledge to the workers regarding nature protection and the need of avoid felling trees during construction • Fruit and timber trees owned by local population will be compensated at their replacement cost according to market prices
Plant Management	• Tree seedlings are planted in a way that minimizes damage to the soil, while facilitating seedling survival. Tree seedling species are selected appropriate for maintaining long-term productivity. • Focus on tree species suitable for site condition • Prevent unreasonable species resulting in slow growth, less water and soil conservation and pest or disease outbreaks • Local species as planting materials, since natural selection and succession are most

Parameter/Activities	Mitigation/Compensation Measure/Guideline
	suitable for local climates and natural conditions • Ensure avoid single species or clone monoculture • Choose suitable species for berm, turfing and side
Planting	• Leave set back requirements around streams, restricted areas e.g. native vegetation, protected riparian strips, historic and heritage sites, research areas. • For nursery raising, physical and biological controls are practiced to control the pests and diseases in the nurseries. • Do not plant spread-prone species on sites where there is a high risk of uncontrollable wilding spread beyond the boundaries of the plantation. • Consider appropriate species, patterns and layout when planting areas with high visual values and/or with important recreational values
Polypropylene Bags Handling	• Make a Borrow Pit at each site for collection of poly bags • Collect all bags at the pits after plantation • If feasible, inform private sector to collect those bag for recycling
Pest Management to Nursery	• During outbreak of any deadly plant disease develop a plan to manage pest in coordination with neighbors by identifying existing pests and diseases and the risks for the introduction of new pests and diseases. • Share the plan with Bank before application.
Water Management	• Install temporary sediment basins, where appropriate, to capture sediment-laden run-off from nursery • Divert runoff from undisturbed areas around the harvesting site • Stockpile of fertilizer or agrichemical away from drainage lines • Prevent all solid and liquid wastes entering waterways by collecting solid waste, oils, chemicals, fertilizer waste and transport to an approved waste disposal site
Fauna	
Construction works in the surrounding lands	• Pre-entry survey and prevention of damage to fauna prior to start up • Limit the construction works within the designated sites allocated to the contractors • Not be permitted to destruct active nests or eggs of migratory birds • Provide adequate knowledge to the workers regarding protection of flora and fauna, and relevant government regulations and punishments for illegal poaching.
ECoP 6: Fisheries Management	
Construction works in the rivers and on the surrounding lands	• Critical breeding areas of major fish species should be identified and declared as sanctuaries. • Creation of small lagoons and pools that may trap the fishes will be avoided. • Creation of artificial waterfalls and other barriers for migration will be avoided. • Natural river channel will be reinstated after completion of construction works
Hydraulic Structure	• Sufficient free flow will be guaranteed in the design and construction work to ensure free pass of migrating fishes. • Hydraulic structure will be operated considering fish migration and spawning time • A guideline for area specific hydraulic structure operation guideline should be developed
Dredging	• Ensure dredging activity will create minimum sediment load in the water • Avoid dredging during spawning period of fish
ECoP 7: Socio-Economic Management	
Construction Camp Management	
Siting and Location of construction Camps (MRDI, 2011)	• Locate the construction camps at areas which are acceptable from environmental, cultural or social point of view. • Consider the location of construction camps away from communities in order to avoid social conflict in using the natural resources such as water or to avoid the possible adverse impacts of the construction camps on the surrounding communities. • BWDB should endorse detailed layout plan for the development of the construction camp submitted by the contractor. The plan should show the relative locations of all temporary buildings and facilities that are to be constructed together with the location of site roads, fuel storage areas (for use in power supply generators), solid waste management and dumping locations, and drainage facilities, prior to the development of the construction camps.

Parameter/Activities	Mitigation/Compensation Measure/Guideline
	• Local authorities responsible for health, religious and security shall be duly informed on the set up of camp facilities so as to maintain effective surveillance over public health, social and security matters
Construction Camp Facilities	The following facilities should be provided by the contractor • Adequate housing for all workers • Safe and reliable water supply • Hygienic sanitary facilities and sewerage system. • Treatment facilities for sewerage of toilet and domestic wastes • Storm water drainage facilities • Provide in-house community/common entertainment facilities, dependence of local entertainment outlets by the construction camps to be discouraged/prohibited to the extent possible.
Solid Waste Management	• Ensure proper collection and disposal of solid wastes within the construction camps • Store inorganic wastes in a safe place within the household and clear organic wastes on daily basis to waste collector. • Establish waste collection, transportation and disposal systems with the manpower and equipment/vehicles needed. • Do not establish site specific landfill sites. All solid waste will be collected and removed from the work camps and disposed in approved disposal sites
Fuel supplies for cooking and heating purposes	• Provide fuel to the construction camps for their domestic purpose, in order to discourage them to use fuel wood or other biomass. • Conduct awareness campaigns to educate workers to protect the biodiversity and wildlife of the project area, and relevant government regulations and punishments on wildlife protection.
Health and Hygiene	• Provide adequate health care facilities within construction sites • Provide first aid facility round the clock. Maintain stock of medicines in the facility • Provide ambulance facility for the laborers during emergency to be transported to nearest hospitals. • Initial health screening of the laborers coming from outside areas • Train all construction workers in basic sanitation and health care issues and safety matters, and on the specific hazards of their work • Provide HIV awareness programming, including STI (sexually transmitted infections) • And HIV information, education and communication for all workers on regular basis • Provide adequate drainage facilities throughout the camps to ensure that disease vectors such as stagnant water bodies and puddles do not form. Regular mosquito repellant sprays during monsoon. • Carryout short training sessions on best hygiene practices to be mandatorily participated by all workers. • Place display boards at strategic locations within the camps containing messages on best hygienic practices
Payment of Wages	• The payment of wages should be as per the Minimum Wages Act, Department of Labor, and Government of Bangladesh for both male and female workers. • Display of the minimum wages board at camps and major construction sites should be done in local languages at the construction and labor camp sites. • Wages should be paid to the laborers only in the presence of BWDB staff; • Contractor is required to maintain register for payment of labor wages with entry of every labor working for him. Also, he has to produce it for verification if and when asked by the Engineer, EMUand/or the concerned BWDB staff/Engineer‘s representative
Rehabilitation of Labor and Construction Camp	At the completion of construction, all construction camp facilities shall be dismantled and removed from the site. The site shall be restored to a condition in no way inferior to the condition prior to commencement of the works. Various activities to be carried out for site rehabilitation include: • Oil and fuel contaminated soil shall be removed and transported and buried in waste disposal areas. • Soak pits, septic tanks shall be covered and effectively sealed off.

Parameter/Activities	Mitigation/Compensation Measure/Guideline
	• Debris (rejected material) should be disposed of suitably. • Underground water tank in a barren/non-agricultural land can be covered. However, in an agricultural land, the tank shall be removed. • If the construction camp site is on an agricultural land, preserve top soil and good earth can be spread back for a minimum 30cm for faster rejuvenation of the land. • Proper documentation of rehabilitation site is necessary. This shall include the following: • Photograph of rehabilitated site; • Land owner consent letter for satisfaction in measures taken for rehabilitation of site; and • Undertaking from contractor; In cases, where the construction camps site is located on a private land holding, the contractor would still have to restore the campsite as per this guideline. The rehabilitation is mandatory and should be include in the agreement with the landowner by the contractor. Also, he would have to obtain a certificate for satisfaction from the landowner.
Damage and Loss of Cultural Properties	
Conservation of Religious Structures and Shrines	• All necessary and adequate care shall be taken to minimize impact on cultural properties which includes cultural sites and remains, places of worship including temples, mosques, churches and shrines, etc., graveyards, monuments and any other important structures as identified during design and all properties / sites / remains notified. No work shall spillover to these properties and premises. The design options for cultural property relocation and enhancement need to be prepared. • All conservation and protection measures will be taken up as per design. Access to such properties from the road shall be maintained clear and clean.
	• During earth excavation, if any property is unearthed and seems to be culturally significant or likely to have archaeological significance, the same shall be intimated to the Engineer. Work shall be suspended until further orders from the PD. The Archaeological Department shall be intimated of the chance find and the Engineer shall carry out a join inspection with the department. Actions as appropriate shall be intimated to the Contractor along with the probable date for resuming the work. • All fossils, coins, articles of value of antiquity and structures and other remains or things of geological or archaeological interest discovered on the site shall be the property of the Government, and shall be dealt with as per provisions of the relevant legislation.
Worker's Accident Risk	
Risk from Operations	• The Contractor is required to comply with all the precautions as required for the safety of the workmen as per the International Labor Organization(ILO) convention. The contractor shall supply all necessary safety appliances such as safety goggles, helmets, masks, books, etc., to the workers and staff. The contractor has to comply with all regulation regarding safe scaffolding, ladders, working platforms, gangway, stairwells, excavations, trenches and safe means of entry and outlet.
Risk from Electrical Equipment	• Adequate precautions will be taken to prevent danger from electrical equipment. No materials on any of the sites will be so stacked or placed as to cause danger or inconvenience to any person or the public. All necessary fencing and lights will be provided to protect the public. All machines to be used in the construction will conform to the relevant Bangladesh Standards (BS) codes, will be free from patent defect, will be kept in good working order, will be regularly inspected and properly maintained as per BS provisions and to the satisfaction of the Engineer.
Risk from Hazardous Activity	• All workers employed on mixing material, cement, lime mortars, concrete etc., will be provided with protective footwear and protective goggles. Workers, who are engaged in welding works, would be provided with welder's protective eye-shields. Stone-breakers will be provided with protective goggles and clothing and will be seated at sufficiently safe intervals.
Malarial Risk	• The Contractor shall, at his own expense, conform to all anti-malarial instructions given to him by the Engineer and the EMU, including filling up any borrow pits which may have been dug by him.
Disruption to Users	

Parameter/Activities	Mitigation/Compensation Measure/Guideline
Loss of Access	• At all times, the Contractor shall provide safe and convenient passage for vehicles, pedestrians and livestock. Work that affects the use of existing accesses shall not be undertaken without providing adequate provisions to the prior satisfaction of the Engineer. • The works shall not interfere unnecessarily or improperly with the convenience of public or the access to, use and occupation of public or private roads, and any other access footpaths to or of properties whether public or private.
Traffic Management	• Special consideration shall be given in the preparation of the traffic control plan to the safety of pedestrians and workers at night • The temporary traffic detours in settlement areasshall be kept free of dust by frequent application of water
Traffic Control and Safety	• The Contractor shall take all necessary measures for the safety of traffic during construction and provide, erect and maintain such barricades, including signs, markings, flags, lights and flagmen as may be required by the Engineer for the information and protection of traffic approaching or passing through the cross section.

7.7.3 Monitoring Plan

229. Extensive monitoring of the environmental concerns of the CEIP project will be required as per World Bank guideline. The monitoring program will help to evaluate: (i) the extent and severity of the environmental impacts against the predicted impacts and baseline; (ii) the performance of the environmental protection measures or compliance with pertinent rules and regulations; (iii) trends in impacts; and (iv) overall effectiveness of the project environmental protection measures. The monitoring plans should be included in the EMP for specific sub-projects. Moreover, for all type of monitoring, a comprehensive **database of the polder specific Environmental Impact and Monitoring information** should be created, which will help to evaluate the impacts easily.

230. The Monitoring activities during design/preconstruction period are:

(i) checking the contractor's bidding documents, particularly to ensure that all necessary environmental requirements have been included; and

(ii) checking that the contract documents' references to environmental mitigation measures requirements have been incorporated as part of contractor's assignment and making sure that any advance works are carried out in good time.

231. Construction environmental monitoring is a function of supervision, and the essential purpose is to ensure adherence to the EMP. The monitoring is a daily process, which ensures that departures from the EMP are avoided or quickly rectified, or that any unforeseen impacts are quickly discovered and remedied.

232. Post monitoring evaluation will be carried to evaluate the impacts of the Project during first three (3) years of operation of the Project. Regular monitoring of the condition of the embankment, drainage structures and slope protection structures and afforestation are important from an environmental management point of view. In addition to this activity, information on the locations, type and consequences of flooding, erosion, flora and fauna mortality, availability of fish, occupational shift, migration is required. Recommended air, noise and water quality monitoring, greening and landscaping and community feedback are also included in the Monitoring Plan. The monitoring plan and details of monitoring locations for environmental condition indicators of the project during the construction and operation stage are presented in Table 7.5 and Table 7.6

Table 7-6 Environmental Monitoring Plan during Construction and Operation of Rehabilitation and Improvement of Polders System

(Source: MRDI, 2011, LGED, 2011)

Parameter	Location	Means of Monitoring	Frequency	Responsible Agency	
				Implemented by	Supervised by
During Construction					
Sources of Material	Work Site	Possession of official approval or valid operating license of suppliers materials (Cement, soil).	Before an agreement for the supply of material is finalized.	Contractor	CS, M&E Consultant, BWDB
Operation of borrow site	Borrow pit/site	Visual inspection of borrow site	monthly	Contractor	CS, M&E Consultant, BWDB
Top Soil	Storage area	Top soil of 0.15 m depth should be excavated and stored properly	Beginning of earthwork	Contractor	CS, BWDB
	do	The stored top soils should be used as cladding material over the filled lands	Immediately after filling and compaction of dredge materials	Contractor	CS, BWDB
	Work Site	Some of the top soil are placed on top and berm of embankment for turfing and plantation	At the end of filling activity	Contractor	CS, BWDB
Erosion	Side slopes of the embankments and material storage sites	Visual inspection of erosion prevention measures and occurrence of erosion	At the end of filling activity	Contractor	CS, M&E Consultant, BWDB
Hydrocarbon and chemical storage	Construction camps	Visual Inspection of storage facilities	Monthly	Contractor	CS, BWDB
Traffic safety	Construction area	Visual inspection to see whether proper traffic signs are placed and flagmen for traffic management are engaged	Monthly	Contractor	CS, BWDB
Air quality (dust)	Construction site	Visual inspection to ensure good standard equipment is in use and dust suppression measures (spraying of waters) are in place.	Daily	Contractor	CS, BWDB
	Material storage sites	Visual inspection to ensure dust suppression work plan is being implemented	Monthly	Contractor	CS
Air Quality (PM_{10}, $PM_{2.5}$)	Close to School/ Madrasha, Hospital & Villages	Air quality monitoring	Half Yearly	Contractor through a nationally recognized laboratory	CS, M&E Consultant, BWDB
Noise	Construction sites	Visual inspection to ensure good standard equipment are in use	Weekly	Contractor	CS, M&E Consultant, BWDB
	Construction	Ensure work restriction	Weekly	Contractor	CS, M&E

Parameter	Location	Means of Monitoring	Frequency	Responsible Agency	
				Implemented by	Supervised by
	sites	between 09:00 pm- 6:00 am close to School/ Madrasha, Hospital & Villages			Consultant, BWDB
Surface Water Quality (TDS, Turbidity, pH, DO, BOD, COD etc)	Water sample at each of river for each polder	Sampling and analysis of surface water quality	Half Yearly	Contractor through a nationally recognized laboratory	CS, M&E Consultant, BWDB
Drinking Water Quality (TDS, Turbidity, pH, FC, as if groundwater etc)	Sources of drinking water at construction camp/site	Sampling and analysis of water quality	yearly	Contractor through a nationally recognized laboratory	CS, M&E Consultant, BWDB
Sanitation	Construction camp/site	Visual Inspection	Weekly	Contractor	CS, M&E Consultant, BWDB
Waste Management	Construction camp and construction site	Visual inspection of collection, transportation and disposal of solid waste and solid waste is deposited at designated site	Weekly	Contractor	CS, M&E Consultant, BWDB
Flora and Fauna	Project area	Survey and comparison with baseline environment	Yearly	Contractor through nationally recognized institute	CS, M&E Consultant, BWDB
Cultural and archeological Sites	At al l work sties	Visual observation for chance finding	Daily	Contractor	CS, M&E Consultant, BWDB
Reinstatement of Work Sites	All Work Sites	Visual Inspection	After completion of all works	Contractor	CS, M&E Consultant, BWDB
Safety of workers Monitoring and reporting accidents	At work sites	Usage of Personal Protective equipment	Monthly	Contractor	CS, M&E Consultant, BWDB
During Operation and Maintenance					
Surface Water Quality (TDS, Turbidity, pH, DO, BOD, COD etc)	Water sample at each of river for each polder	Sampling and analysis of surface water quality	Yearly	BWDB through a nationally recognized laboratory	M&E Consultant
Air Quality (Dust PM_{10}, $PM_{2.5}$)	At the baseline monitoring site	24 hours Air quality monitoring	Yearly	BWDB through a nationally recognized laboratory	M&E Consultant
Flora and Fauna specially fisheries	In the project area	Detail species assessment and compare with baseline	Yearly	BWDB through a nationally recognized institution	M&E Consultant
Agriculture	In the project area	Compare the production with the baseline	Yearly	BWDB through a nationally recognized institution	M&E Consultant
Operation of hydraulic structure	In the project area	Visual inspection and public feedback	Yearly	BWDB	M&E Consultant

Table 7-7 Environmental Monitoring Plan during Construction and Operation of Afforestation

Parameter	Location	Means of Monitoring	Frequency	Responsible Agency	
				Implemented by	Supervised by
During Implementation					
Plant Selection	Nursery	Visual inspection. Type and variety of plant species to be planted for turfing on the top of embankment and foreshore	Before plantation	Contractor	CS, BWDB, M&E Consultant
Water Quality	Water bodies near nursery	Odor and chemical testing	Half yearly	Contractor through nationally recognized laboratory	CS, BWDB, M&E Consultant
Waste Management	Work site and Nursery	Visual inspection of collection,transportation and disposal of grasses, debris and is deposited at designated site	Weekly	Contractor	CS, BWDB, M&E Consultant
	Work site and Nursery	Visual inspection of Water bars & cut-offs .sediment traps to prevent water pollution caused by run-off from harvesting areas	Beginning of work	Contractor	CS, BWDB, M&E Consultant
Nursery Embankment Management	Nursey	Visual inspection of height of embankment, possibility of water logging and connection to the waterbodies	Beginning of each nursery	Contractor	CS, BWDB, M&E Consultant
During Operation and Management					
Multilevel belt of trees	Polder top and along the polder	Visual inspection	yearly	BWDB through nationally recognized institution	M&E Consultant
Flora and Fauna	In the project area	Detail species assessment and compare with baseline	Yearly	BWDB through a nationally recognized institution	M&E Consultant
Erosion	Along Alignment	Visual Inspection presence of gullies or erosion	Yearly	BWDB	M&E Consultant

233. In addition to the critical locations selected during design stage, the environmental monitoring will also be done at the construction camp site and any other plant site during construction stage. List of critical locations for caring out monitoring should be presented in the IEE/EIA report

7.7.4 Qualitative Spot Checking Indicators

234. Moreover a rapid environmental monitoring will be carried out according the following checklist in terms of visual judgment during field visit as an indirect control to implement Environmental Mitigation plan.

Table 7-8 Spot Checking Indicator

Parameter	Visual Judgment		
	Poor	Moderate	Satisfactory
Workers Safety			
Camp Site Management			
Plant Site Management			
Borrow Area Management			
Top Soil Prevention			
Waste Management			
Reporting and Documentation			

7.7.5 Implementation of EMP & Report Requirement

235. Contractor is responsible for implementation of EMP during construction works and Construction Supervision Consultant (CS) is primarily responsible for supervision of the implementation of the EMP.

236. BWDB will conduct field inspections and surveys by the environment specialist (to be employed by BWDB on regular basis) at field. S/he will report to the Senior Environment Specialist at Head Quarter.

237. The M&E consultant will be responsible for independent monitoring and implementation of EMP, and external monitoring and evaluation.

238. DoE will be consulted if complicated issues arise during construction and operation stages. BWDB will apply for annual site clearance from DoE.

239. BWDB will prepare the **half yearly progress report** on environmental management and will submit to the World Bank for review.

240. The World Bank will review the screening report, environmental management plan, monitoring reports on random basis and will carry out field visit to cross-check. The contributing development partners may also join in the field visit to understand the environmental compliance of the project.

241. Moreover, for all type of monitoring, a comprehensive database of the polder specific Environmental Impact and Monitoring information should be created, which will help to evaluate the impacts easily. The data base will be incorporated with the mainstream BWDB MIS. Environment, Social and Communication (ESC) unit will be responsible for updating the database for environmental information.

242. Water Management organizations (WMO) will be formed under the Bangladesh Guidelines for Participatory Water Management (Nov 2000) and involve the beneficiary communities. WMOs will be trained by BWDB to ensure environmental management during project operation. Environmental Management Unit of BWDB will ensure and oversee the environmental management during project implementation and operation.

243. In addition, the effectiveness of screening, monitoring and implementation of EMP will be carried out by the **third party monitoring** firm along with the project component activity monitoring annually. The **Annual Environmental Audit Report** prepared by the third party monitoring firm will be shared with World Bank.

7.7.6 Guideline to Incorporate Environmental Management in Bid Document

- Prepare cost estimates, to be incorporate in Bid Documents.

- Environmental Management Plan along with the good environmental construction guidelines to be incorporated in the bid document's work requirements.
- Preparation of work requirement (addendum/corrigendum to polder & hydraulic structure construction/afforestation) and
- Corrigendum / Addendum to polder/embankment specification, if any, as special provisions to be incorporated in bid document.
- Penalty clauses for not complying with EMP requirements to be incorporated. Indicative penalty clauses proposed in the CEIP are presented below (Addendum to Clause 17.2 Contractor's Care of the Works of FIDIC).
    - The contractor has to follow all traffic safety measures as defined in the technical specification. Damage shall be levied at the rate Tk. 3000/- per day per location for non – conformity of traffic safety measures as per the decision of the engineer.
    - The contractor has to follow all environmental mitigation measures as defined in the technical specification read along with the Environmental Management Plan for the specific CEIP activities. Damage shall be levied at the rate Tk. 3000/- per day per location for nonconformity of Environmental Management Plan measures as per the decision of the BWDB Engineer.
    - The contractor has to ensure that prior to every monsoon season, during the construction period; all the temporary and permanent cross drainage structures are free from debris as defined in the Technical Specifications read along with the Environmental Management Plan. Damage shall be levied at the rate of Tk.3000/- per day per location for non-conformity as per the decision of the Engineer.
    - The contractor has to ensure that sufficient numbers and good quality Personnel Protective Equipment (PPE), should be provide to staff and labor all time as defined in the labor codes read along with the EMP. Damage shall be levied at the rate of Tk. 1000/- per day for non-conformity as per the decision of the Engineer.

- Since many contractors do not have clear understanding the need of environmental management, some quoted very low price for implementation of EMP and eventually cannot implement EMP as per design. To avoid this problem, Fixed Budget will be assigned for EMP implementation. The contractors may need orientation on the requirement of the EMP in the pre-bidding meeting. The contractor needs to submit an **Environmental Action Plan (EAP)** based on the EIA and EMF in line with the construction schedule and guideline. The EAP needs to be reviewed by the supervision consultant and cleared by BWDB and World Bank.

7.7.7 Guideline for Compensation and Contingency Plan during Project Period

244. Compensation becomes necessary when project impacts cannot be satisfactorily mitigated. This can be paid in cash or kind and the emphasis should be on ensuring fairness and causing minimum inconvenience to the affected party. The most common cause of compensation payment is displacement of people and loss of productive land due to land acquisition, tree cutting, or property damage. Such impacts can rarely be fully compensated. The compensation should be given as per provision of the Resettlement Action Framework. Any disputes over the compensation should be handles by the Grievance Redress Committee.

245. In addition to the compensation, water management projects should also have a contingency plan to deal with emergencies and accidents. Such incidences encompass a whole range of situations from personal injury during operation of a machine to breaching of an embankment. Therefore, BWDB would prepare for the following emergency situations:

- Embankment failure during a flood – keep sufficient number of sand bags in reserve.
- Bank caving/erosion – keep sufficient number of concrete blocks and sand bags in reserve.
- Have an emergency evacuation plan for the people in the line of danger.
- Have a place designated as emergency shelter and ensure proper water supply, power supply and sanitation at this site.
- Accidental spill of pesticide or similar harmful chemicals – train some members on how to confine such a spill and minimize potential danger to humans and other animals.
- Fire – keep fire extinguisher or emergency water pump ready at local project office.
- Personal injury – keep a first aid box at the project office. Have a plan for quickly transporting a seriously injured person to the nearest hospital.

7.8 Methods for estimating costs and benefits of the impacts and mitigation/enhancement measures

246. It is very crucial to estimate the benefits of the project interventions, damages/loss due to the impacts as well as cost and benefits of mitigation / enhancement measures for proper evaluation of the proposed project. Quantitative and qualitative approach can be followed depending on the indicators to be measured or estimated. Some of the methods are described below. These methods need to be applied while conducting detail EIA study.

7.8.1 Methods for estimating costs of environmental damages

247. Valuation of environmental damages due to proposed project can be estimated using direct and indirect valuation methods with specific indicators of damages. For instance, reduction of fish capture can be estimated from the differences of fish catch between before project and after project situation, whereas loss of migratory fish can be estimated through counting number of fish species in before project and after project situation. Similar example of damage estimation methods are given in Table 7.8. Some of the damages can be expressed in monetary terms, some are not. In such case, multi criteria based combined index can be calculated to estimate value of overall negative impacts of the proposed project.

Table 7-9: Example of methods for Estimating Costs of Environmental Damages

Possible Negative Environmental Impacts	Method for estimating damages
• **Capture fish habitat will decrease due to new regulators**	Estimating market value of the amount of fish catch decreased due to new regulators in the channel (Taka/ year)
• **Some migratory fish species may be reduced due to closure dam or constructing new regulators**	Counting number of migratory fish species decreased
• **Aquatic habitat area will be reduced due to closure dam.**	Estimating area of aquatic habitat reduced (ha)

7.8.2 Methods for estimating benefits of the direct positive impacts of the project

248. Similar methods will be used for estimating benefits of the project as the methods for estimating damages. Examples of methods for estimating benefits of the positive environmental impacts are shown in Table 7.9.

Table 7-10: Example of methods for estimating benefits of positive environmental impacts

Possible Positive Environmental Impacts	Method for estimating benefits
• Cropped area will increase due to increase of flood free and salinity free area, irrigation facilities	Estimating value of additional crop produced in the increased cropped area due to project (Taka/year in each polder)
• Capture fish production will increase due to channel re-excavation	Estimating value of fish catch increased due to channel re-excavation in each polder (Taka/ year)
• Fish migration will improve as well as species diversity will improve due to channel re-excavation	Counting number of migratory fish species increased
• Shrimp farms will increase inside polders	Estimating value of shrimp production in increased shrimp area in each polder (Taka/ year)
• Employment opportunity will increase	% of employment
• Employment opportunity of the local labor will increase during construction of embankment	% of employment

• Household income and food consumption will be improved due to flood free environment	Estimating the amount of household income increased after project interventions
• Population migration will decrease due to increase of flooding free area	% of day labor migrating to other areas
• Quality of life indicators such as housing, drinking water, health and sanitation will be improved	% of households having access to safe drinking water supply and sanitation
• Women status in the society may improve gradually	% of woman employment

7.9 Cost of implementing EMP and source of funds

249. Tentative cost of implementing proposed mitigation plan, enhancement plan, compensation and contingency plan, and monitoring plan need to be estimated. The financial costs and benefits of mitigation/enhancement measures can be estimated based on the material and human resources requirements for the particular mitigation/ enhancement measures. Some example of methods for estimating cost and benefits of mitigation/ enhancement measures are shown in Table 7.10.

Table 7-11: Example of methods for estimating cost and benefits of mitigation/ enhancement measures

Mitigation/ Enhancement Measures	Objective	Items to be included for estimating cost	Items to be included for estimating benefits
Enhancement measures			
Alternative communication system (e.g. submersible road) can be developed	To improve communication system	- Materials and labor for constructing roads cost - Price of land cost	- Reduction of travel cost and time
Support of DAE should be extended to promote sustainable agriculture practices (with low agro-chemical inputs, efficient irrigation system)	To reduce overuse of agro-chemicals and promote efficient irrigation system in the protected polder areas	- Organizing training and public awareness program cost - Demonstration project for sustainable agriculture cost	- Increase of net benefit from agriculture production
Afforestation	To increase fuel wood and timber production	- Cost of seedlings, and labor - Maintenance cost - Awareness program	- Market value of potential timber and fuelwood production
Mitigation measures			
Adopting erosion control and soil stabilization measures is necessary to maintain embankments and protect tidal flooding	To reduce river bank erosion	- Erosion protection works cost	- Protected land area - Protected population - Protected agriculture crop production
Construction of fish friendly structures like fish-pass instead of traditional structures. In other cases openings of outlet structures should be made as wide as possible for relatively free movement of fishes during migration.	To reduce loss of migratory fish species and increase fish production	- Construction cost of fish friendly structures - Maintenance cost of structures	- Fish production - Number of migratory fish species

250. Cost for implementing monitoring plan should include the following items:

- Cost for Laboratory Data Testing
- Remuneration of professionals of monitoring team
- Cost for field visits and data collection (including surveyor, travel, etc.)
- Cost for laboratory test of required environmental parameters

- Cost for report production, etc.
- Coat for WMO Training and Capacity Building
- Cost of activity specific mitigation measures

251. All the costs for implementing EMP should be included in the project budget. The funds for implementing EMP can be generated from the following sources, depending on the measures mentioned in EMP. Specific suggestions should be made in the EIA report.

- Budget of the CEIP project
- Projects of other departments (e.g. enhancement measures for agriculture can come through DAE; fisheries management projects of DoF, Forestry project)
- O & M budget for CEIP project from government revenue budget
- Livelihood development program through NGOs and donor agencies
- Special fund created by local beneficiaries/ stakeholders

7.10 Grievance Redress Mechanism

252. BWDB will establish a grievance redress mechanism (GRM) as a means to ensure social accountability and to answer to queries and address complaints and grievances about any irregularities in application of the guidelines adopted in this EMF for assessment and mitigation of social and environmental impacts. Based on consensus, the procedure will help to resolve issues/conflicts amicably and quickly, saving the aggrieved persons from having to resort to expensive, time-consuming legal action. The procedure will however not pre-empt a person's right to go to the courts of law.

7.10.1 Grievance Redress Focal Points

253. A Grievance Redress Committee (GRC) at local level will be formed for each Union with union level representation to ensure easy accessibility by the project affected persons and communities. This local GRC will be the local focal points of the project GRM. The GRM sets out the information and communications strategy to ensure that PAPs and communities are fully informed about their rights to offer suggestions and make complaints. All grievances received through the GRM process will primarily be forwarded to the GRCs. The Secretariat for each GRC will be at the office of the Executive Engineer. If any grievance is not resolved at GRC, the aggrieved person may request the convener of GRC to forward the case to the Project Director at PMO, Dhaka. The GRC will officially forward the cases with their comments to the Project Director. Hearing of petitions with GRCs will be held at the Convener's office or at Union Parishad/Ward Councillor's office as agreed by the committee members. The membership of the GRCs will ensure proper presentation of complaints and grievances as well as impartial hearings and investigations, and transparent resolutions.

Membership of GRC

1. Executive Engineer (BWDB Division Office)	:	Convener
2. Representative of the RP Implementing NGO	:	Member-Secretary
3. Local UP Chairman /Ward Councillor	:	Member
4. Teacher from Local Educational Institution (nominated by Upazila Administration)	:	Member
5. Representative from Local Women's Group	:	Member
1. Representative from the PAP Group	:	Member

254. Members of the GRCs will be nominated by the Executive Engineer at division level and approved by the Project Director, PMO, BWDB, Dhaka.

7.10.2 Grievance Resolution Process

255. All complaints will be received at the GRCs facilitated by the implementing agency. The aggrieved persons may opt to make complaints directly to the Project Director or Secretary of the MoWR

or even to the court of law for resolution. The Member Secretary will review and sort the cases in terms of nature of grievance, urgency of resolution, and schedule hearings in consultation with the Convener. All cases will be heard within four weeks from the date of receiving the complaints.

256. If the resolution attempt at the local level fails, the GRC will refer the complaint with the minutes of the hearings to the Project Director at PMO for further review. The Project Director will assign the ESC at PMO for review the grievance cases and assist Project Director in making decision. The ESC will review the case records and pay field visits for cross examining and consult the GRC members and aggrieved persons, if required. If a decision at this level is again found unacceptable by the aggrieved person(s), BWDB can refer the case to the MoWR with the minutes of the hearings at local and headquarters levels. At the ministry level, decisions on unresolved cases, if any, will be made in no more than four weeks by an official designated by the Secretary, MoWR. A decision agreed with the aggrieved person(s) at any level of hearing will be binding upon BWDB.

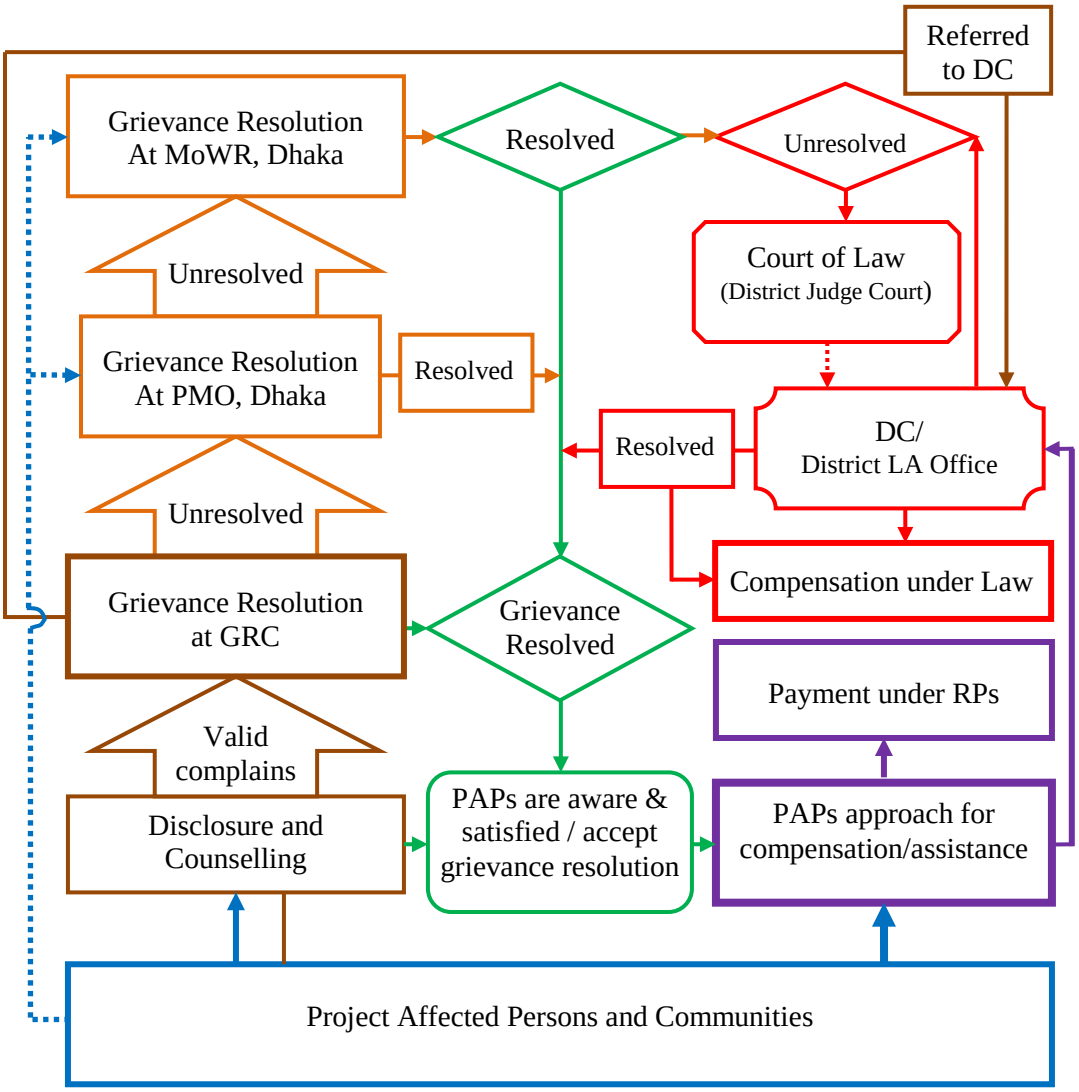


Figure 7-3 GRM Process Flow Chart

257. To ensure that grievance redress decisions are made in formal hearings and in a transparent manner, the Convener will apply the following guidelines:

- Reject a grievance redress application with any recommendations written on it by a GRC member or others such as politicians and other influential persons.
- Remove a recommendation by any person that may separately accompany the grievance redress application.

- Disqualify a GRC member who has made a recommendation on the application separately before the formal hearing:
  - Where a GRC member is removed, appoint another person in consultation with the Project Director.
- The Convener will also ensure strict adherence to the impact mitigation policies and guidelines adopted in this SMRPF and the mitigation standards, such as compensation rates established through market price surveys.

7.10.3 GRM Disclosure, Documentation and Monitoring

258. The affected persons and their communities will be informed of the project's grievance redress mechanism in open meetings at important locations and in PAP group meetings. Bangla translations of the EMF and the GRM in the form of information brochures will be distributed among the project affected persons. The PAPs will also be briefed on the scope of the GRC, the procedure for lodging grievances cases and the procedure of grievance resolution at the project level.

259. To ensure impartiality and transparency, hearings on complaints will remain open to the public. The GRCs will record the details of the complaints and their resolution in a register, including intake details, resolution process and the closing procedures. BWDB will maintain the following three Grievance Registers:

- **Intake Register**: (1) Case number, (2) Date of receipt, (3) Name of complainant, (4) Gender, (5) Father or husband, (6) Complete address, (7) Main grievance regarding social (loss of land/property or entitlements) or environmental, (8) Complainants' story and expectation with evidence, and (8) Previous records of similar grievances.
- **Resolution Register**: (1) Serial no., (2) Case no.,(3) Name of complainant, (4) Complainant's story and expectation, (5) Date of hearing, (6) Date of field investigation (if any), (7) Results of hearing and field investigation, (8) Decision of GRC, (9) Progress (pending, solved), and (10) Agreements or commitments.
- **Closing Register**: (1) Serial no., (2) Case no., (3) Name of complainant, (4) Decisions and response to complainants, (5) Mode and medium of communication, (6) Date of closing, (7) Confirmation of complainants' satisfaction, and (8) Management actions to avoid recurrence.

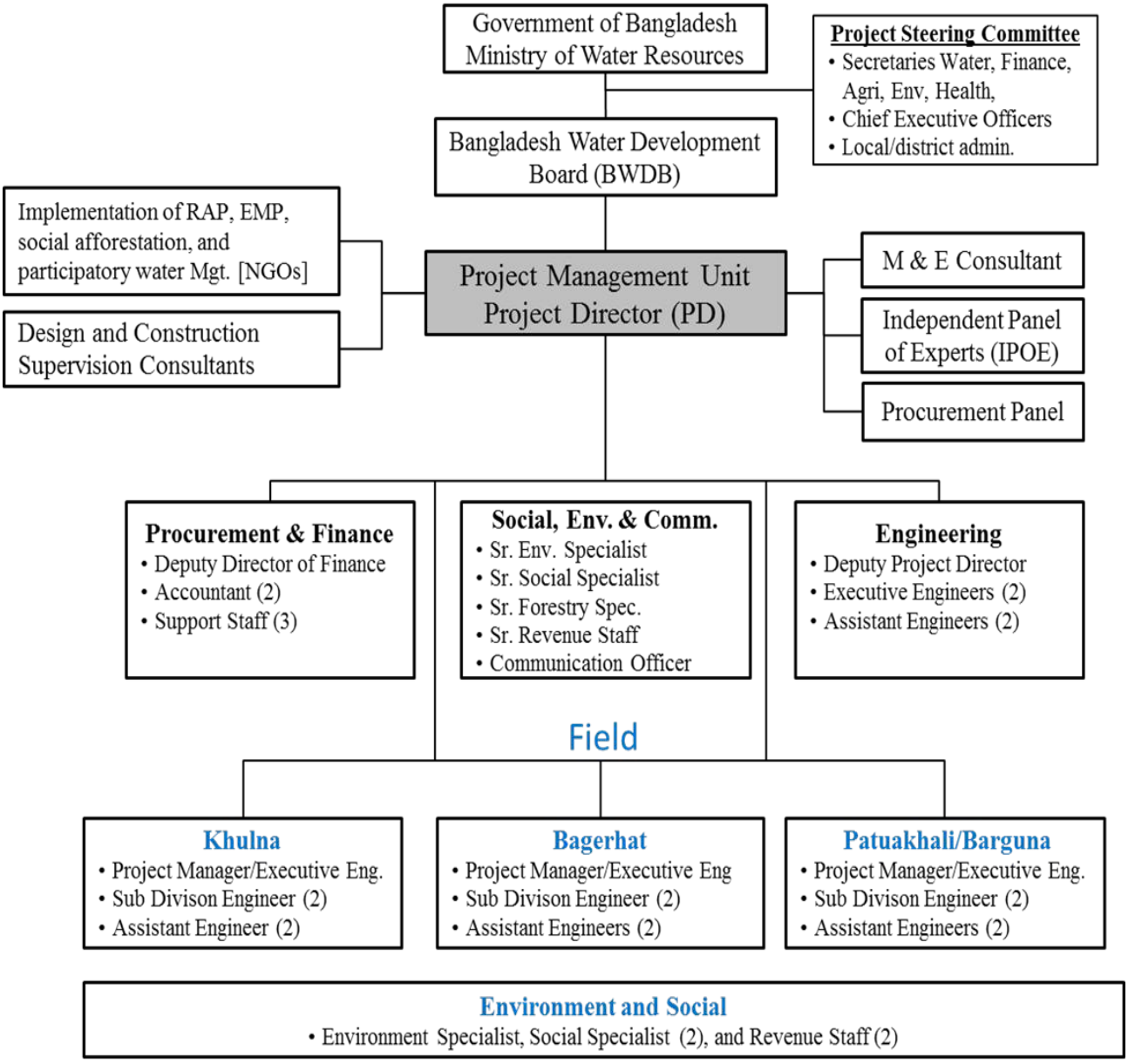
260. Grievance resolution will be a continuous process in RP implementation. The PMO and SMOs will keep records of all resolved and unresolved complaints and grievances (one file for each case record) and make them available for review as and when asked for by WB and any other interested persons/entities. The PMO will also prepare periodic reports on the grievance resolution process and publish these on the BWDB website. The format in Annex 3 of SMF may be used for periodic grievance reporting.

Chapter 8 Institutional Arrangements and Capacity Building

8.1 Introduction

261. A robust institution arrangement is required for ensuring sustainable environment friendly development. The institutional arrangement includes organizational support, training needs and plan and management information system. The following section captures these institutional arrangements for EMF implementation by concerned officials of BWDB, their consultant and working contractors. The organization structure that will be adopted by BWDB headquarter and field level to ensure the proper implementation of the project in general and the EMF in particular is shown in Figure 8.1.

Figure 8-1 BWDB Institutional Arrangement for CEIP Implementation



8.2 Environment, Social and Communication (ESC) Unit

262. The ESC to be established to implement and manage the EMF will be structured to provide co-ordination, technical support and services during the environmental screening and preparation of EA, and implementation of the environmental mitigation measures. Functions and the staffing responsibilities of ESC are listed in Table below. In order to effectively manage the EA process and EMP implementation, the ESC will be established and made operational awarding the contract to contractor. One senior Environment Specialist will be at head quarter. One environment specialist will be posted at the field level to support all three divisions.

Table 8-1: Functions and Responsibilities of the ESC

Designation	Function/Responsibility
ESC (Sr. Environment Specialist)	• Assist the PD in conducting environmental screening and categorization of each polder; • Assist the PD in implementation of the EMF during the project implementation period; • Preparation of EA and finalization of the same in close co-ordination with the PIC and the World Bank; • Ensure integration of the EA and resulting EMP into the polder redesign and implementation plans (contract documents); • Ensure compliance of the mitigation measures by the Contractors; • Ensure incorporation of appropriate environmental specifications (on the basis of screening and ECP) into the respective bidding & contract documents; • Assist the BWDB Engineers at site by providing appropriate environmental advice, and developing appropriate environmental mitigation measures foreach polder; • Documenting the experience in the implementation of the environmental process; • Assist PIC consultant's and BWDB community organizer to carryout participatory consultation during planning, design and implementation; • Assist the PD in obtaining Environmental Clearances from the DOE; • Assist in development of training program for the key stakeholders (BWDB, contractors, public representatives and local government institutions/ NGOs, in collaboration with the field level junior Environmental Specialist; • Review and approve the Contractor's Implementation Plan for the environmental measures, as per the EMP; • Liaison with the Contracts, CS for the Implementation of the EMP; • Liaison with the DOE on environmental and other regulatory matters; • Interact with the NGOs and Community based organizations to be involved in the project for EMP implementation; • Dialogue with the project affected persons (PAPs) and ensure that the environmental concerns and suggestions are incorporated and implemented in the project; • Undertaking environmental monitoring and reporting to the Project Director and follow-up activities; • Assist field level junior environment specialist to resolve any environment related issue in the project • Document the standard construction practices in the project on incorporation and integration of environmental issues into engineering design and on implementing measures in the polder reconstruction/rehabilitation and maintenance programs; • Assist the PD to arrange for the Environmental Auditing and follow up action on the Audit recommendation. • Report to the PD on the environmental aspects pertaining to the project. • To guide and assist the PD and the BWDB to strengthen the environmental management practices in polder rehabilitation, hydraulic structure construction. • Ensuring Update of Database for polder specific environmental information • Prepare periodic progress reports on the implementation of the EMF for transmission to the World Bank throughout the project implementation period. • Update of Environmental Management Plan and Environmental Impact Assessment after receiving information from the contractors and design consultants. • Capacity Building of the responsible assistant and deputy chief responsible for environmental sustainability assurance of BWDB project • Maintaining Polders Specific Database for Environmental Management

Field Level Environment Specialist	• Assist the Design Consultants in Environmental screening process • Assist the PMU in Environmental Assessments for the projects; • Assist PMU in obtaining of requisite Environmental Clearances for the project; • Assist the Senior Environment Specialist and the Environmental Specialist of the Design Consultants and CS consultants in preparation of the training materials and in conducting training; • Review the contractor's Implementation Plan for the environmental measures, as per the EMP with assistance from the Environmental Specialist of the MS and DS consultant; • Liaison with the contractors and CS on the implementation of the EMF and EMP; • Carry out consultations with the NGOs and Community groups to be involved in the project; • Establish dialogue with the affected communities and ensure that the environmental concerns and suggestions are incorporated and implemented in the project; • Carry out site inspections, check and undertake periodic environmental monitoring and initiate necessary follow-up actions; • Document the good practices in the project on incorporation and integration of environmental issues into engineering design; • Report to the Executive Engineer (Environment) / PD on the environmental aspects pertaining to the project; • Assist in the preparation of periodic reports for dissemination to the PMU, World Bank, etc

263. BWDB core unit has posts of 4 Assistant Chief and 2 Deputy Chief to oversee the overall environmental compliance of BWDB implemented projects. Under CEIP, the ESC unit will provide training to the BWDB people responsible for monitoring of environmental compliance. Thus smooth transition to BWDB will happen to ensure environmental compliance during the O&M after the project completion.

8.3 Project Construction Supervision Consultant (CS)

264. The CS consultants will be responsible for overall supervision of polder rehabilitation related activities. The CS consultants will ensure quality control and report to PD. The CS will also assist the ESC for ensuring environmental compliance and monitoring of progress including EMP and/or ECP implementation.

265. BWDB will ensure that proper environmental screening, IEE and EIA for each polder has been done. BWDB will have separated Environmental Consulting Firm to conduct the environmental screening (ES), IEE and EIA. Design consultant will ensure findings from the ES, IEE or EIA have been addressed in the design. . BWDB will conduct verification of some screening and assessment. BWDB will ensure the design consultant has incorporated the findings from ES, IEE and EIA in the design.

266. The project will support at least one or more (need based) Environment Specialist in Supervision. The specialists will prepare subproject specific environment screening/assessment report with EMP, supervise the implementation of EMP and support capacity building of the field level staff of BWDB and contractor. ESC will review the EMF and ensure quality of the environmental screening/assessment with EMP. The project will implement an environmental monitoring program (i) to monitor the contractor's work during project implementation in order to check contractual compliance with specified mitigation measures, and subsequently (ii) to assess the actual environmental impacts of the project over the years following completion of the various project components. The Senior Environment Specialist of ESC will design the detailed monitoring plan of the project and prepare a routine monitoring report based on the monitoring results by BWDB. In addition, the environmental audit will be carried out before the mid-term evaluation and before project closing. The Bank would also supervise the environmental compliance as part of regular implementation support missions.

8.4 Contractor

267. The Contractor will be responsible for implementation of all environmental related activities under the project. In addition, the contractor shall be responsible for familiarizing themselves with "Chance Finds Procedures" in the IEE/EIA's Report incase culturally valuable materials are uncovered during excavation or any project activities.

Chance-Find Procedures for Physical Cultural Property

268. The Contractor will be responsible for familiarizing themselves with the following "Chance Finds Procedures" in case culturally valuable materials are uncovered during excavation or any project activities, including:

- Stop work immediately following the discovery of any materials with possible archeological, historical, paleontological, or other cultural value, announce findings to project manager and notify relevant authorities;
- Protect artifacts as well as possible using plastic covers, and implement measures to stabilize the area, if necessary, to properly protect artifacts;
- Prevent and penalize any unauthorized access to the artifacts; and
- Restart construction works only upon the authorization of the relevant authorities.

8.5 Monitoring

269. The ESC will dedicate part of its time to monitor all project activities and reporting to the PD. Regular monitoring of activities is carried out by CEIP divisional offices and supervision consultants at site and is being reviewed by the ESC on monthly basis. The ESC and Directors also take regular review of ongoing project activities including environment issues and corrective measures if required are implemented at site. For environmental components of a project, environmental monitoring plan is developed, based on baseline data and impacts predicted during the environmental assessment process. The concerned forest department staffs, as part of their duties monitor impacts on ecological resources and activities of afforestation. The environmental monitoring plan for each project will be integrated with construction, operation and maintenance and shall be monitored by the ESC on a monthly basis. The higher management is apprised through a monthly report. The ESC will share a half yearly monitoring report with Bank.

8.6 Capacity Building & Training

270. Since the effectiveness of the Environmental Assessment & implementation depends considerably on the understanding and preparedness of their Engineers and in particular their Environmental Team (**Consisting of Contractor Environmental specialist, Consultant environmental specialist, and ESC of BWDB**). It is important that the project authority makes effort to sensitize the Engineers and Environmental Team on management of environmental issues, provides guidance, and encourages them to build requisite capacities. Capacity building can be achieved by two prong strategy.

- Training program for existing staff.
- Technical Assistance: knowledge sharing with consultants, having requisite expertise.

271. Component D – Project Management, Technical Assistance, Training and Strategic Studies will support institutional capacity building, technical assistance and training. The project will provide funding for essential technical assistance (TA), consulting services and advanced staff training. Under a TA consultancy service a technical (EMS) training and capacity building expertise for roll out of EMS requirements in BWDB units and via Workshops for contractors, consultants and other external stakeholders will be undertaken.

272. Capacity building training programs should be undertaken in the following area:

- Training of the management level officials of BWDB, BWDB environmental compliance personnel on the overall environmental concerns and responsibilities for implementing EMP
- Recruitment of new professionals with background on environment, if required and provide necessary training
- Organizing workshop, seminar, with stakeholders on the environmental concerns of CEIP
- Special training program for the contractors and workers on the EMP and their responsibilities, who will actually be involved in the construction of the project interventions. The Contractors will be provided guideline for preparation of Environmental Action Plan in line with the construction workplan
- Training of the WMOs on successful operation of hydraulic structures
- Training on structured format in reporting for all stages of implementation and those of relevant agencies who are involved in EMP implementation.

273. The training programs should be arranged before implementation of the interventions in the polder area. Detail plan can be made by the proposed 'Environment Unit' of BWDB.

Chapter 9 Public Consultation and Disclosure

9.1 Introduction

274. Public Consultation and Disclosure is mandatory for the EA study of any development project according to the EIA Guidelines of DoE as well as World Bank. Public consultation and disclosure aims to involve the stakeholders in the project development and implementation process. During consultation process, the proposed project planning interventions along with the alternative options are discussed while the results of impact assessment are shared during the disclosure sessions. The proposed interventions and alternative options for respective coastal polder development under CEIP project were consulted with stakeholders and findings are presented in this chapter. Also methods of disclosure of the findings of environmental assessment are presented here.

9.2 Objectives of public consultation and disclosure

275. The main objective of public consultation and disclosure is to involve local inhabitants/stakeholders of coastal polders in project planning and implementation process. The specific objectives of public consultation and disclosure were to:

- get feedback on the proposed project interventions and possible environmental and social impacts
- know about the perceived ideas of stakeholders on mitigation/ enhancement/ compensation/ contingency of potential negative/positive impacts of the proposed interventions
- inform the stakeholders about possible land acquisition (LA), if any, and its impacts on different group of people including vulnerable one;
- know about the possible conflict of interest, if any, and suggestions for resolving those;
- make the stakeholders aware about the possible environmental and social impacts;
- share the results of impact assessment according to the important environmental and social components with the stakeholders;

9.3 Approach and Methodology of Public Consultation

276. As part of the Environmental Assessment of CEIP project, two stage 'public consultation' need to be carried out – local level and national level. **Already four public consultation meetings were conducted** at local level in the coastal area (see Table 9.1 and Figure 9.1). List of participants attending in the public consultation meetings is given in Appendix – 11. National level consultation workshop will be conducted after preparation of the 'draft Environmental Management Framework'.

Table 9.1: Public consultation meetings in coastal polders

Sl. No	Meeting place	District	Hydrological zone	Date	Total number participants
1	Upazila Hall room Chakaria Upazila	Cox's Bazar	CCP	19 December, 2011	42
2	Upazila Hall room, Ramgati Upazila	Lakshmipur	MDP	21 December, 2011	42
3	Upazila Hall room, Dacope Upazila	Khulna	GTPW	26 December, 2011	37
4	Upazila Hall room, Barguna Sadar Upazila	Barguna	GTPE	28 December, 2011	44

277. Participatory approach was followed for identifying the participants as well as conducting public consultation. Initially the consultants talked with the Upazila Chairman, Upazila Nirbahi Officer (UNO), UP Chairman and knowledgeable person in the study area to get clear view of the study area and to get

support for identifying the potential key persons who should be invited to attend the consultation meetings. The venue, date and time of those meetings were fixed in consultation with Upazila Nirbahi Officer (UNO) as well as the key persons of the respective venues. In the four consultation meetings, Upazila Chairman, Upazila Nirbahi Officer (UNO), upazila officials from different departments (fisheries, agriculture and livestock etc.); Chairman, Member and secretary of Union Parishad, local people of different occupation including farmers, businessmen, day laborers, farm and non-farm laborers, etc; the knowledgeable persons including teachers, service holders, journalist etc. and representatives of project authority participated. The type and number of participants who attended the meeting are given in Appendix - 11.

Stakeholder consultation workshop in Chakaria, Cox's Bazar

Stakeholder consultation workshop in Dacope, Khulna

Stakeholder consultation workshop in Ramgati, Lakhsmipur

Stakeholder consultation workshop in Barguna Sadar, Barguna

Figure 9.1: Public consultation meetings held in coastal areas

278. The consultant used necessary checklists for facilitating the public consultation meetings to maintain uniformity and relevancy in discussion and recording the opinions and views of the participants properly. The checklist was prepared covering the issues like overall briefing of the proposed project including the Feasibility/EA study level of the project, problem of the area with the potential solutions, proposed interventions and alternative options, probable impacts of selected interventions etc. During consultation meeting all relevant issues within socio-economic, agricultural, hydrological, fisheries, and ecological aspects were discussed in detail. A multi-disciplinary consultant team facilitated the consultation meeting where the other members of the team including Water Resource Engineer, Agriculturist, Fishery Biologist and Ecologist attended and assisted as necessary. The consultants displayed maps of the study area, explained the initial baseline condition, and the proposed initial interventions. The facilitators explained all relevant points and issues in order to enable the participants to comprehend the proposed initial interventions/activities properly and to respond, accordingly. The stakeholders were asked to point out the potential problems and solutions and develop the project

interventions in line with the initial proposal. The stakeholders' perceived views over the impacts on important environmental and social components (IESCs) along with perceived benefits, risks, threats and demand from the project were identified. The consultants took utmost care in recording opinions and views of the participants relevant to the EMF Report.

9.4 Issues discussed in the Public Consultation Meetings

279. The checklist used for consultation includes the following issues:

1. Knowledge of the participants about the CEIP and attitude of people towards the proposed project interventions.
2. Perception of local people about problems regarding the polder and suggestions for solution of the perceived problems considering:
   - Water resources (surface water, siltation, water salinity, drainage, ground water salinity, water infrastructure management etc.)
   - Land and agriculture resources (Soil quality & fertility, agriculture production & yield, crop damage etc)
   - Fishery resources (open water fishing, brackish water fish culture, shrimp production & yield, virus infestation etc)
   - Socio-economic resources (occupation & employment, migration, quality of life, communication, conflict of interest of shrimp-rice farming, gender aspect etc.)
3. Sustainable solution of the above potential problems of the polder in the line with the aspects of:
   - Water resources management
   - Land and agriculture recourses management
   - Fishery recourses management
   - Socio- economic resources management, and
   - Disaster management
4. Perception of impacts (both positive and negative) on water, agriculture, fishery, socio-economic and disaster aspects due to implementation of proposed project interventions
5. Suggestions on enhancement (positive impacts) and mitigation (negative impacts) measures.

9.5 Findings of the Public Consultation Meetings

280. The findings obtained from the consultation meetings are summarized below:

Problems in coastal areas including polders:

- Cyclone and storm surges are one of the major hazards in the coastal area.
- Cyclone along with storm surges are creating unfortunate deaths and huge damage of crops and houses due to breaching of embankment
- Crisis of irrigation water during agriculture practices, fish culture (Fresh/sweet water), plant etc. due to Salinity increase/salinity intrusion
- The agricultural land is losing its normal productivity day by day because of salinity intrusion
- Proper irrigation facilities are required for dry season crop production
- Water supply and sanitation facilities should be improved
- Silted up rivers and khals
- Drainage congestion/water logging is hampering agriculture, fisheries, shrimp/prawn culture
- Over flow of water during rainy season due to unprotected area
- Early flood due to storm surges in the coastal area are affecting agriculture, fisheries, shrimp/prawn culture and salt culture
- Weak WMO activities
- Absence of LGI's participation during implementation of project

Solutions/ mitigations:

- Construction of sufficient cyclone shelter

- cyclone early forecasting should be ensured
- increase the activities of CPP
- Initiate re-excavation of river and khals
- River training should be taken up
- Initiate river bank protection through geo-bag along the erosion side of the embankment
- Construction and repairing of the sluice gate /regulator
- Heightening of the embankment at least by 15-20 ft.
- Afforestation in the slope of embankment and in fallow land of BWDB/Government.
- Heightening and repairing of the embankment
- Land acquisition should be ensured before construction of dyke/embankment
- Ensure active participation of LGI during project implementation

Knowledge about intervention and location:

- Some participants know about the proposed project.
- They have very positive attitude towards the proposed project.
- They believe that CEIP project is the solution of all of their problems and hazards.

Perception on predicted impacts:

Participants have perceived following positive impacts of the proposed project:

- Settlement will be saved from tidal flood
- Huge fallow land will come under cultivation
- Fish culture will increase
- Road communication facility will increase
- Farmer will get appropriate rate of production
- Trade and commerce will increase
- Small and cottage industry will be introduced
- Employment opportunity and income generation will be enhanced due to agriculture practices and fish farming
- Afforestation will be introduced and this will protect the area from natural calamity more effectively
- Livestock and poultry rearing will increase
- Education and health facilities will increase
- Safe drinking water and sanitation will be promoted
- law and order situation and crime will be reduced due to improvement of better road communication and increase of employment opportunity

9.6 Modes of Future Consultations during Implementation

281. A range of formal and informal consultative methods will be carried out for all project activities including, but not limited to: focus group discussions, public meetings, community discussions, and in depth and key informant interviews; in addition to the censuses and socio-economic surveys. Consultations will be held with special emphasis on vulnerable groups. Encouraging public participation in consultations informs the public and serves as a venue for the public to express their opinion on priorities which the Project should address. The key stakeholders to be consulted during polder reconstruction/rehabilitation work preparation and program implementation includes:

- All project affected persons (PAPs), including vulnerable households;
- Project beneficiaries;
- Host populations in resettlement sites (if any);
- Political party representatives, community leaders, and representatives of community based organizations;
- Local NGOs;
- Officials of municipalities and relevant government agency representatives

282. The municipality with support and guidance from the CS consultants will ensure that PAPs and other stakeholders are informed and consulted about the reconstruction/rehabilitation activity, its impact, their entitlements and options, and allowed to participate actively in the development of the sub-project. This will be done particularly in the case of vulnerable PAPs, who will be encouraged to choose options that entail the lowest risk. This exercise will be conducted throughout the sub-project-during preparation, implementation, and monitoring of sub-project results and impacts.

283. Under the harmonized safeguard policy, two public consultations will be required for the Project as part of the environmental assessment procedure. ESC will prepare the program of public meetings, presentations about the Project and drafting the comments sheet in English and Bengali.

284. Information on the public consultation meetings will be published in national and regional newspapers 10 days prior to the consultations. Announcements on the commencement of the Environmental Assessment in the newspaper, the availability of the Background Information Document, the venue and the schedule of consultations and public opinion feedback processes will be published in the national newspapers.

9.7 Plan for Consultations

285. While the same process as was followed during the project preparation will also be followed during further selection, planning and design of the sub-project, the Table 9.1 shows the consultation process to be followed during the implementation stage.
286.

Table 9-1: Plan for Participatory Consultation during Project Implementation

Facilitation	Frequency	Target People
ESC/Consultants	Quarterly	Key Informants (Local Leaders: Elected/Additional, Upazila GOB Officials, MPs, NGOs/CBOs Community based Organizations
CEIP Environment Specialist	Fortnightly/ Weekly	NGOs/CBOs Community based Organizations, Users, beneficiaries, and project affected persons (PAPs)
Community Organizer, Upazila BWDB	Weekly/ Biweekly	Users, beneficiaries, and project affected persons

9.8 Public Disclosure Requirement

287. The results of draft environmental assessment study for CEIP project will be disclosed to the local and national level stakeholders through different methods as described below.

a. *Workshop:* Workshops would be organized at the local and national level to disclose the findings of the environmental assessment study of CEIP project (e.g. proposed project's objectives, description, potential impacts and summary of EA). Representative of implementing authority, the study team, and the government officials from different departments, representatives from LGIs, and representatives from NGOs, local communities of different occupation, journalist, and local elite/civil society may attend the workshops. In the workshops, the participants will share their observations, views, and remarks with the study team. Appropriate suggestions and recommendations on different issues from the stakeholders of the meeting would be incorporated in the environmental assessment study especially the EIA/SIA. The workshops will also help to resolve conflicting issues among stakeholders.

b. *Publication in electronic and print media:* The summary information on project interventions and the findings of environmental assessment would also be disclosed through newspapers and electronic media (e.g. internet, TV, radio, etc.). All information would be disclosed in Bengali language.

c. *Availability of the Document:* The Environmental Assessment, documenting the mitigation measures and consultation process, will be made available for public review in both English and Bengali. The summary EA will be published on the BWDB and WB websites, and the full environmental report will be available upon request from the WB and will be accessible in BWDB website. Hard copy of the EA and EMF will be available at CEIP Divisional office.

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Appendix 1: List of Coastal Polders

SL.No.	Polder No.	Location: Name of Thana	District	CEIP Zone	Remark
1	1	Assasuni, Debhata & Satkhira	Satkhira	GTPW	
2	2	Assasuni, Satkhira	Satkhira	GTPW	
3	3	Debhata, Kaliganj	Satkhira	GTPW	
4	4	Assasuni	Satkhira	GTPW	
5	5	Kaliganj, Shyamnagar	Satkhira	GTPW	
6	6-8	Assasuni, Satkhira, Tala	Satkhira	GTPW	
7	6-8 (Extn)	Satkhira, Kalarua	Satkhira	GTPW	
8	7/1	Assasuni, Shyamnagar	Satkhira	GTPW	
9	7/2	Assasuni.	Satkhira	GTPW	
10	9	Paikgacha.	Khulna	GTPW	
11	10-12	Koyra, Paikgacha	Khulna	GTPW	
12	13-14/2	Koyra	Khulna	GTPW	
13	14/1	Koyra	Khulna	GTPW	
14	15	Shymnagar	Satkhira	GTPW	
15	16	Paikgacha, Tala	Khulna, Satkhira	GTPW	
16	17/1	Dumuria	Khulna	GTPW	
17	17/2	Dumuria	Khulna	GTPW	
18	18/19	Paikgacha	Khulna	GTPW	
19	20	Paikgacha	Khulna	GTPW	
20	20/1	Paikgacha	Khulna	GTPW	
21	21	Paikgacha	Khulna	GTPW	
22	22	Paikgacha	Khulna	GTPW	
23	23	Paikgacha	Khulna	GTPW	
24	24	Abhaynagar, Dumuria, Keshobpur, Manirampur	Jessore, Khulna	GTPW	
25	25	Dumuria Fultala	Khulna	GTPW	
26	26	Dumuria	Khulna	GTPW	
27	27/1	Dumuria	Khulna	GTPW	
28	27/2	Dumuria	Khulna	GTPW	
29	28/1	Dumuria	Khulna	GTPW	
30	28/2	Batiaghata	Khulna	GTPW	
31	29	Batiaghata, Dumuria	Khulna	GTPW	
32	30	Batiaghata	Khulna	GTPW	
33	31	Dacope	Khulna	GTPW	
34	31 Part	Batiaghata	Khulna	GTPW	
35	32	Dacope	Khulna	GTPW	Phase 1
36	33	Dacope	Khulna	GTPW	Phase 1
37	34/1	Bagerhat	Bagerhat	GTPW	
38	34/3	Bagerhat	Bagerhat	GTPW	
39	35/1	Sharankhola	Bagerhat	GTPW	Phase 1
40	35/3	Bagerhat	Bagerhat	GTPW	Phase 1
41	36/1	Bagerhat, Chitalmari, Fakirhat, Morelgonj, Rupsa	Bagerhat, Khulna	GTPW	
42	39/1A	Pathargatha	Barguna	GTPE	
43	39/1C	Mathbaria	Pirojpur	GTPE	
44	39/2A	Bamna	Pirojpur	GTPE	
45	39/2C	Mathbaria, bhandaria	Pirojpur	GTPE	Phase 1

SL.No.	Polder No.	Location: Name of Thana	District	CEIP Zone	Remark
46	39/1B	Mathbaria	Barguna	GTPE	
47	40/1	Pathargatha	Barguna	GTPE	
48	40/2	Pathargatha	Barguna	GTPE	
49	41/1	Barguna Sadar	Barguna	GTPE	
50	41/2	Barguna Sadar	Barguna	GTPE	
51	41/3	Barguna Sadar	Barguna	GTPE	
52	41/4	Barguna Sadar	Barguna	GTPE	
53	41/5	Barguna Sadar	Barguna	GTPE	
54	41/6A	Barguna Sadar	Barguna	GTPE	
55	41/6B	Barguna Sadar	Barguna	GTPE	
56	41/7	Mirjaganj	Patuakhali	GTPE	
57	Mirjaganj- Rampura	Mirjaganj	Patuakhali	GTPE	
58	41/7A	Betagi	Barguna	GTPE	
59	Bibichini	Betagi	Barguna	GTPE	
60	41/7B	Betagi	Barguna	GTPE	
61	42	Barguna Sadar	Barguna	GTPE	
62	43/1	Amtali	Barguna	GTPE	
63	43/1A	Amtali	Barguna	GTPE	
64	43/1B	Kalapara	Patuakhali	GTPE	
65	43/2A	Patuakhali	Patuakhali	GTPE	
66	43/2B	Galachipa, Amtali, Patuakhali	Patuakhali,	GTPE	
67	43/2C	Galachipa	Patuakhali	GTPE	
68	43/2D	Patuakhali	Patuakhali	GTPE	
69	43/2E	Patuakhali	Patuakhali	GTPE	
70	43/2F	Amtali	Patuakhali	GTPE	
71	Dumki-laowkathi	Patuakhali	Patuakhali	GTPE	
72	Itbaria Labukhali	Patuakhali Sadar	Patuakhali	GTPE	
73	44	Amtali, Kalapara	Patuakhali	GTPE	
74	45	Amtali	Patuakhali	GTPE	
75	46	Kalapara	Patuakhali	GTPE	
76	47/1	Kalapara	Patuakhali	GTPE	
77	47/2	Kalapara	Patuakhali	GTPE	
78	47/3	Kalapara	Patuakhali	GTPE	
79	47/4	Kalapara	Patuakhali	GTPE	
80	47/5	Kalapara	Patuakhali	GTPE	
81	48	Kalapara	Patuakhali	GTPE	
82	50/51	Rangabali	Patuakhali	GTPE	
83	52/53A	Galachipa	Patuakhali	GTPE	
84	52/53B	Galachipa	Patuakhali	GTPE	
85	54	Kalapara, Amtali	Patuakhali	GTPE	
86	55/1	Galachipa	Patuakhali	GTPE	
87	55/2A	Patuakhali, Galachipa, Amtali	Patuakhali	GTPE	
88	55/2B	Galachipa	Patuakhali	GTPE	
89	55/2C	Galachipa	Patuakhali	GTPE	
90	55/3	Galachipa, Char fashion	Patuakhali, Bhola	GTPE/ MDP	
91	55/4	Galachipa	Patuakhali	GTPE	
92	Satla-Bagda-1	Uzirpur	Barisal	GTPE	
93	Salta Bagda-2	Agailjhara, Wazirpur	Barisal	GTPE	

SL.No.	Polder No.	Location: Name of Thana	District	CEIP Zone	Remark
94	Salta Bagda-3	Agailjhara, Wazirpur	Barisal	GTPE	
95	56/57	Bhola Sadar, Borhanuddin,	Bhola	MDP	
96	58/1	Manpura	Bhola	MDP	
97	58/2	Manpura	Bhola	MDP	
98	58/3	Manpura, Sudharam	Bhola	MDP	
99	59/1A	Companiganj,	Noakhali	MDP	
100	59/1B	Sudharam, Laxmipur	Noakhali,	MDP	
101	59/2	Ramgati	Laxmipur	MDP	
102	59/2 Extension	Ramgati	Laxmipur	MDP	
103	59/3B	Sudharam	Noakhali	MDP	
104	59/3C	Companiganj	Noakhali	MDP	
105	60	Sonagazi	Feni	MDP	
106	61/1	Sitakundu	Chittagong	CCP	
107	61/2 (Chittagong)	Mirsharai	Chittagong	CCP	
108	62	Bandar, Patenga & Pahartali	Chittagong	CCP	
109	63/1A	Anowara	Chittagong	CCP	
110	63/1B	Anowara	Chittagong	CCP	
111	64/1A	Banshkhali	Chittagong	CCP	
112	64/1B	Banshkhali	Chittagong	CCP	
113	64/1C	Banshkhali	Chittagong	CCP	
114	64/2A	Chakoria	Chittagong	CCP	
115	64/2B Mognama	Chakoria	Cox's Bazar	CCP	
116	65	Chakoria	Cox's Bazar	CCP	
117	65/A	Chakoria	Cox's Bazar	CCP	
118	65/1A	Chakoria	Cox's Bazar	CCP	
119	65/A3	Chakoria	Cox's Bazar	CCP	
120	66/1	Cox's Bazar	Cox's Bazar	CCP	
121	66/2	Cox's Bazar & Ramu	Cox's Bazar	CCP	
122	66/3	Cox's Bazar	Cox's Bazar	CCP	
123	66/4	Chakoria	Cox's Bazar	CCP	
124	67	Teknaf	Cox's Bazar	CCP	
125	67/A	Teknaf & Ukhiya	Cox's Bazar	CCP	
126	67/B	Teknaf	Cox's Bazar	CCP	
127	68	Teknaf	Cox's Bazar	CCP	
128	69/NE	Moheshkhali	Cox's Bazar	CCP	
129	69/Pase-1	Moheshkhali	Cox's Bazar	CCP	
130	70	Moheshkhali	Cox's Bazar	CCP	
131	71	Kutubdia	Chittagong	CCP	
132	72	Swandip	Chittagong	CCP	
133	73/1 (A&B)	Hatiya	Noakhali	MDP	
134	73/2	Hatiya	Noakhali	MDP	
135	Boyerchar	Hatiya	Noakhali	MDP	
136	CDSP-II	Sonagazi	Noakhali	MDP	
137	Charbagerdona-1	Subornachar	Noakhali	MDP	
138	Charbagerdona-2	Subornachar	Noakhali	MDP	
139	Char mujit	Subornachar	Noakhali	MDP	
	Kumira to Sonaichari flood control project	Sitakundu	Chittagong	CCP	

Appendix 2: Common Capture Fisheries Species In Coastal Area Of Bangladesh

Local name	English name	Species name	Local name	English name	Species name
Finfish					
Bhetki	Sea Bass	*Lates calcarifer*	Pangas	Fatty catfish	*Pangasius pangasius*
Hilsha	Hilsha shad	*Tenualosa ilisha*	Karati chela	Whitefin wolfherring	*Chirocentrus nudus*
Parsia	Goldspot mullet	*Liza parsia*	Tapasi	Paradise threadfin	*Polynemous paradesious*
Bol	Malabar grouper	*Epinephelus malabaricus*	Tular danti	Ladyfish threadfin	*Sillago domina*
Kain magur	Ealtail catfish	*Plotosus canius*	Phasa	Gangetic hairfin anchovy	*Setipinna phasa*
Poa		*Pama pama*	Baila	Tank goby	*Glossogobius giuris*
Kaikka	Spottail needlefish	*Strongylura strongylura*	Tengra	Long-whiskered catfish	*Mystus gulio*
Shell fish					
Tiger chingri	Green tiger shrimp	*Penaeus semisulcatus*	Bagda	Tiger shrimp	*Penaeus monodon*
Bhati chingri	Rice shrimp	*Acetes indicus*	Horina chingri	Speckled shrimp	*Metapenaeus monoceros*
Golda	Giant freshwater prawn	*Macrobrachium rosenbergii*			
Edible crabs					
Kakra	Mud crab	*Scylla serrata*	Kakra	Three spot swimming crab	*Neptunas sanguinolentus*

Appendix 3: Protected areas in the coastal zone of Bangladesh

Name	Ecosystem type	Total area (ha)	Location
Reserved forest			
	Forest	885,043	Bagerhat, Barguna, Bhola, Chittagong, Cox's Bazar, Feni, Khulna, Lakshmipur, Noakhali, Patuakhali, Satkhira
National Park			
Himchari	Peninsula	1,729	Cox's Bazar, Hatiya, Noakhali
Nijhum Dweep	Island	4,232	
Eco-park			
Sitakundu	Forest	808	Chittagong
Wildlife Sanctuaries			
Sundarban East	Mangrove	31,227	Bagerhat
Sundarban South	Mangrove	36,970	Khulna
Sundarban West	Mangrove	71,502	Satkhira
Char Kukri Mukri	Island	2,017	Bhola
Chunati	Forest	7,761	Chittagong
Companiganj	Forest	5,074	Noakhali
Game Reserve			
Teknaf	Peninsula	11,615	Cox's Bazar
Ramsar Site			
Sundarban	Mangrove	601,700	Bagerhat, Satkhira, Khulna
ECAs			
Sonadia	Island	4,916	Cox's Bazar
Teknaf Beach	Peninsula	10,465	Cox's Bazar
St. Martin Island	Island	590	Cox's Bazar
Impact zone of Sundarbans (10 km buffer area outside Sundarbans	Rivers and settlements		Bagerhat, Satkhira, Khulna
World Heritage Site			
Wildlife Sanctuaries of the Sundarban	Mangrove		Bagerhat, Satkhira, Khulna
Shaat Gombuz Mosque		0.16	Bagerhat, Satkhira, Khulna
Marine Reserve			
	Marine	69,800	Bay of Bengal
Fish Sanctuaries			
	Lotic /Lentic	15,614	Barisal, Bagerhat, Bhola, Patuakhali, Feni, Lakshmipur, Jessore , Satkhira, Khulna and Narail

Appendix 4: Common flora and fauna habituating in coastal region of Bangladesh

Table 5-1: Baseline Situation of common flora occurring in the coastal area

Local name	Scientific name	Habitats	Plant Type	Present status
Terrestrial flora				
Sirish	*Albizzia lebbeck*	R, H	TT	VC
Sissoo	*Dalbergia sissoo*	R, H	TT	C
Mehogoni	*Swietenia mehogoni*	R, H	TT	C
Babla	*Acacia Arabica*	R, H	TT	FC
Neem	*Azadirachta indica*	R, H	TT	R
Karoi	*Samania saman*	R, H	TT	R
Kadam	*Anthocephalus chinensis*	R, H	TT	R
Bakul	*Mimusops elengii*	R, H	TT	VR
Kathal	*Artocarpus heterophyllus*	H	TT/FT	C
Mango	*Mangifera indica*	H	TT/FT	C
Lichu	*Litchi chinensis*	H	FT/TT	R
Amra	*Spondias pinnata*	H	FT	VR
Jaam	*Syzium cumini*	H	FT/TT	R
Peyara	*Psidium guajava*	R, H	FT	R
Tetul	*Tamarindus indica*	H	FT/TT	R
Papa	*Carica papaya*	H	FT	R
Coconut	*Cocos nucifera*	H	FM	C
Supari	*Areca catechu*	H	FM	C
Palm	*Borassus flabeliffer*	R, H	FM	R
Banana	*Musa sp.*	H	FM	C
Khejur	*Phoenix sylvestris*	R,H	FM	VC
Sarifa	*Anona squamosa*	H	FT	VR
Bel	*Aegle marmelos*	H	FT	VR
Bamboo	*Bamboosa spp.*	H	Bushes	C
Marginal land flora				
Chechur	*Scirpus articulatus*	WL	Herb	R
Helenchaa	*Enhydra flactuans*	WL	Herb	R
Hogla	*Typha angustata*	WL	Bushes	R
Madur pati	*Cyperus pangorei*	WL	Bushes	
Kolmi	*Ipomoea fistulosa*	WL	Shrub	R
Aquatic flora				
Shapla	*Nymphaea nouchali*	SW	SMH	R
Jhanjhii	*Hydrilla verticillata*	SW	SMH	VC
Patajhanjhee	*Vallisneria spiralis*	SW	SMH	FC
Kochuripana	*Eichhornia crassipes*	SW	FFH	VC
Topapana	*Pistia strateotes*	SW	FFH	VC
Azolla	*Azolla sp*	SW	FFH	C
Salvinnia	*Salvinnia sp*	SW	FFH	C
Singara	*Trapa bispinosa*	SW	FFH	R
Mangrove flora				

Local name	Scientific name	Habitats	Plant Type	Present status
Gol	*Nipa fruticans*	SL	Bushes	R
Geowa	*Excoecharia agallocha.*	SL	TT	R
Ora	*Sonneratia sp.*	SL	TT	R
Hargoza	*Acanthus illicifolius*	SL	Shrubs	R
Source: CEGIS field survey				
Note: FC=Farely Common; VC=Very Common; C= Common; R= Rare; E=Endangered; VR=Very Rare; R= Roadside; H=Homestead; ML=Marginal land; SL=Salty land; SW=Stagnant water; TT=Timber Tree; FT=Fruit bearing Tree; FM=Fruit bearing Monocot; SMH=Submerged Hydrophytes; FFH=Free Floating Hydrophyte.				

Table 5-2: Baseline Situation of common fauna occurring in the coastal area

Local Name	Scientific Name	Food	Baseline Status
Local Birds			
Doel	*Copsychus saularis*	Insects	C
Crow	*Corvus splendens*	Garbase, dead animals	C
Kokil	*Eudynamys scolopacea*	Insects	R
Dove	*Streptopelia chinensis*	Insects, cereals	R
Kingfisher	*Alcedo atthis*	Fish	C
Fingey	*Dicrurus adsimilis*	Insects	C
Sparrow	*Passer domesticus*	Cereals	C
Woodpeker	*Dinopium bengalensis*	Insects	R
Bowkathakow	*Oriololus xanthornus*	Insects	R
Bulbuli	*Pycnonotus cafer*	Fruits, cereals	R
Tuntuni	*Orthotomus sutorious*	Insects, fruits	C
Shama	*Copsychus malabaricus*	Insects	VR
Sada khanjan	*Motacilla cinera*	Fish, insects	R
Kite	*Haliastur indica*	Fish, birds	R
Hutumpecha	*Ketupa zylonensis*	Rat, crab, insects	VR
Seasonal Birds			
Large Egret	*Egretta alba*	Fish	R
Dahuk	*Amaurornis phoenicurus*	Fish, cereals	VR
Kalim	*Porphyrio porphyrio*	Cereals, insects	R
Hottiti	*Vanellus malabaricus*	Insects, snails	VR
Balihash	*Nettpuscoromandelianus*	Fish,	R
Kanabok	*Ardeola grayii*	Fish	R
Pankewri	*Phalacrocrocorax niger*	Fish	R
Reptiles			
Bengal lizard	*Varanus flavescens*	Insects	R
Common lizard	*Calotes versicolor*	Insects	C
Water snake	*Xenocrophis pisctor*	Frog, fish	C
Mammals			
Comn.Langour	*Semnopithacus entellus*	Fruits, cereals	E
PalmSquarrel	*Funambulus penanti*	Fruits	C
Jungle Cat	*Felis chaus*	Small animals	E
Indian Fox	*Vulpes bengalensis*	Fruits, small animals	R

Civet Cat	*Vivera zibetha*	Fish, small animals	E
Mongoose	*Herpestes edwarsii*	Fruits, fishes	R
Common Otter	*Luttra luttra*	Fishes	E
Flying Fox	*Pteropus giganteus*	Fruits	R
Amphibians			
Common Toad	*Bufo melanostictus*	Insects	FC
Tree Frog	*Polypadates maculatus*	Insects	C

FC=Farely Common; VC=Very Common; C= Common; R= Rare; E=Endangered; VR=Very Rare
Source: Field survey

Appendix 5: List Of Polders Likely To Be Overtopped In Baseline And Climate Change Scenario

Sl. No.	Sea Dyke	Length	Overtopping	
			Base	2050
		(km)	(m)	(m)
1	P40/1-2	59	2.5	2.7
2	P41-42	81	2	3.25
3	P45	26	1.25	1.5
4	P46-47	80	1.75	2
5	P48	38	1.2	2
6	P50/51	48	1.8	2.25
7	P52/53	40	2.5	3
8	P54	60	1.8	2.25
9	P55/1	46	1.4	1.75
10	P55/3	53	1.25	2
11	P55/4	31	2.9	3.75
12	P56/57(E)	140	2.5	3.25
13	P56/57(W)	90	1.5	2.5
14	P58/1	32	3.25	5
15	P58/2	28	3.3	4.25
16	P59/2	93	3.25	4
17	P59/3B	70	4.5	6
18	P59/3C	42	4	6.5
19	P60	45	4.25	6.5
20	P61/1	26	3.5	6.4
21	P61/2	45	1	6.5
22	P62	22	2.5	5.5
23	P63/1A-Raipur	20	1.5	4.5
24	P64/1A	54	1.75	6.25
25	P64/2b-Mognama	27	1	3.5
26	P64/2b-Ujantia	22	0	3.5
27	P66/3	37	0	0.5
28	P69	29	0	1.25
29	P70	29	1	1.75
30	P71	41	1.75	4.25
31	P72	62	4	5.5
32	P73/1	89	2.3	3.5
33	P73/2	48	2.6	3

Sl. Nos.	River Dyke	Length	Overtopping Depth	
			Base	2050
		(km)	(m)	(m)
1	P07/1	32	0	1
2	P07/2	64	0	1
3	P10-12	67	1	1
4	P13-14/2	122	0	1
5	P23	37	0	1.5
6	P31	63	0	1
7	P32	49	0	1
8	P33	52	0	1
9	P35/1	62	1	2.5
10	P35/2	105	1	2.5
11	P35/3	40	0	1.5
12	P36/2	87	0	1.5
13	P37	100	1	2.75
14	P38	40	2	2.75
15	P39/1	96	2	2.5
16	P39/2	109	1.5	3.25
17	P41/6-7	95	0.75	1
18	P42	28	2	3.25
19	P43/1	114	1.8	2
20	P43/2	121	1.8	2
21	P44	84	1.5	2.2
22	P55/2	109	1.9	2.75
23	P63/1A -Battali	38	1.75	5.6
24	P64/2A	59	0	5
25	'2b-joakkhal-Kor	17	0	3
26	P64/2b-Pekua	30	0	3.75

Note: Polders that are not overtopped in both scenarios are not listed. Overtopping height of 0 meters indicates that the polder is not overtopped in that scenario.

Source: World Bank 2011

Appendix 6: Environmental Screening Format for Rehabilitation and Construction of Coastal Polder

Name of Polder: Year of construction:
BWDB Division:
District: Upazila: Union (s):

A. **Technical Information**

1 Size of scheme (ha): _____
2 Type of scheme (FCD/ FCDI):_____

3 Condition of infrastructures:

3a	Embankment:	Total length: _____km Length of Breaching:___km	Length of embankment to be raised/ repaired:_____km
3b	Structures (No.):	Regulators:_____ Drainage cum flushing inlets/ sluice:_____ Inlets:_____	*Structures need to be repaired or newly constructed* Regulators: *Old:___ New:__* Drainage cum flushing inlets/ sluice: *Old:____ New:___* Inlets: *Old:___ New:___*
3c	Drainage khals:	Total length:	Total length *(after improvement)*:____km
3d	Irrigation canals:	Total length:	Total length *(after improvement)*: ____
3e	Others (irrigation inlet, culvert, bridge etc)) (No.):	Irrigation inlet: Culvert: Bridge:	Irrigation inlet *(after improvement)*: ____ Culvert *(after improvement)*:__ Bridge *(after improvement)*:__
4	Drainage congestion:	Present condition: □ Yes □ No	Post project condition: □ Yes □ No

5 Major Components of the improvement works:
a. Embankment raising: _____km
b. Repairing emb. breaching:_____ km
c. New embankment: _____ km
c. Repairing Regulators: Repairing _____(no.), New _____ (no.)
d. Drainage cum flushing inlets/ sluice: Repairing _____(no.), New _____ (no.)
e. Inlets: Repairing _____(no.), New _____ (no.)
f. Drainage channel re-excavation: _____ km
g. New drainage channel excavation: _____ km
g. Others:_____

B. **Potential Environmental Impacts**

Questions	Yes	No	Degree of Impact			Remarks
			High	Medium	Low	

Is the sub-project area adjacent to or within any of the following environmentally sensitive areas?						
☐ Protected Area	□	□	□	□	□	
☐ Wetland	□	□	□	□	□	
☐ Mangrove	□	□	□	□	□	
☐ Estuarine	□	□	□	□	□	
☐Buffer zone of protected areas	□	□	□	□	□	
B. 2 Will the sub-project cause……						
a. negative effects on rare (vulnerable), threatened or endangered species of flora or fauna or their habitat?	□	□	□	□	□	
b. negative effects on designated wetlands?	□	□	□	□	□	
c. negative effects on wildlife habitat, populations, corridors or movement?	□	□	□	□	□	
d. negative effects on locally important or valued ecosystems or vegetations?	□	□	□	□	□	
e. destruction of trees and vegetation	□	□	□	□	□	
f. loss of agricultural land and topsoil?	□	□	□	□	□	
g. impact on cropping intensity?						
h. impact on crop production?						
i. destruction of fish habitat?	□	□	□	□	□	
j. obstruction of fish migration and navigation?	□	□	□	□	□	
k. obstruction of natural connection between river and wetlands inside project area?	□	□	□	□	□	
l. water logging in polder areas?	□	□	□	□	□	
m. insufficient drainage leading to salinity intrusion?	□	□	□	□	□	
n. negative effects on surface water quality, quantities or flow?	□	□	□	□	□	
o. negative effects on groundwater quality, quantity or movement?	□	□	□	□	□	
p. increased soil erosion and /or sedimentation?	□	□	□	□	□	
q. negative impact on soil stability and compactness?	□	□	□	□	□	
r. impacts on sustainability of associated construction waste disposal?	□	□	□	□	□	
s. increased noise due to transportation of equipment and construction materials?	□	□	□	□	□	
t. increased noise due to day-to-day construction activities?	□	□	□	□	□	
u. increased wind-blown dust from material (e.g. fine aggregate) storage areas?	□	□	□	□	□	
v. Other effects:_____	□	□	□	□	□	

C. **Potential Social/institutional Impacts**

Questions	Yes	No	Degree of Impact			Remarks
			High	Medium	Low	
Will the sub-project interventions cause……						

a. negative effects on neighborhood or community characters?	□	□	□	□	□	
b. negative effects on local business, institutions or public facilities?	□	□	□	□	□	
c. Displacement of people?	□	□	□	□	□	
d. chance of land acquisition from the people for the implementation?	□	□	□	□	□	
e. loss of existing buildings, property, economic livelihood?	□	□	□	□	□	
f. potential social conflict between occupational groups (farmers vs fisheries)?	□	□	□	□	□	
g. degradation or disturbance of historical or culturally important sites (mosque, graveyards, monuments etc.)?	□	□	□	□	□	
h. blockage of navigation system?	□	□	□	□	□	
i. impediments to movements of people and animals?	□	□	□	□	□	
j. conflicts in water supply rights and related social conflicts?	□	□	□	□	□	
k. health risks to labors involved in activities?	□	□	□	□	□	
l. traffic disturbances due to construction material transport and wastes?	□	□	□	□	□	
m. Other effects:_____	□	□	□	□	□	

D. Cumulative impacts

Questions	Yes	No	Degree of Impact			Remarks
			High	Medium	Low	
Will the demonstration cause……						
a. Increase flood situation outside the polders?	□	□	□	□	□	
b. river bed rise outside polder due to low water flow?	□	□	□	□	□	
c. Scarcity of capture fisheries?	□	□	□	□	□	
d. loss of natural ecosystem?	□	□	□	□	□	
e. Over exploitation of natural resources?	□	□	□	□	□	
f. Change of occupation of local people?	□	□	□	□	□	
n. Other effects:_____	□	□	□	□	□	

Note: Please add any other screening questions relevant to the sub-project. Also provide additional comments and/or positive impacts in "remarks" column.

Recommendations:

Screening form filled by: _____ Signature:_____ Date____

Verified by: _____ Signature:_____Date_____

Appendix 7 Environmental Screening Format for Foreshore Afforestation

Name of Polder: Year of construction:
BWDB Division:
District: Upazila: Union (s):

E. **Technical Information**

1 Size of scheme (ha): _____
2 Type of scheme (FCD/ FCDI):_____

3 Condition of infrastructures:
3a Embankment: Total length: _____km Length of embankment to be raised/ repaired:_____km

4 Species to be planted
Along the shore:
On the top :

Screening Questions	**Yes**	**No**	**Scale of Impact**				**Remarks**
			High	**Medium**	**Low**	**No**	
Is the nursery adjacent to or within any environmentally sensitive areas?							
Is there any tubewell adjacent to nursery?							
Is the tubewell used for drinking purpose?							
Will the subproject disturb the ecosystem of habitats, populations, movement or effects on rare, threatened or endangered species of flora or fauna?							
Will the implementation of the subproject involve any land acquisition and involuntary resettlement							
Is the selected plant a familiar species?							
Will the subproject cause pollution of water bodies due to disposal of agrochemical, fertilizer or other wastes							
Will the subproject cause soil infertility due to harvesting							
Will the subproject create							

Screening Questions	Yes	No	Scale of Impact				Remarks
			High	Medium	Low	No	
scope for plantation of trees and laying vegetative coverage in the area?							
Will the subproject require tree felling or disruption of vegetation in the area or impair beneficial uses of traditional forest							
Will the sub-project create drainage congestion or water logging, cross-drainage problem contributing risks to natural systems							
Impact on fish migration and navigation?							
Negative effects on groundwater quality, quantity or movement?							
Blockage of navigation system?							
Impediments to movements of people and animals?							
Health risks to labors involved in activities?							
Possible Mitigation measures (if the area is affected)					Possible Alternative Measures:		

Note: Please add any other screening questions relevant to the demonstration. Also provide additional comments and/or positive impacts in 'remarks' column.

Recommendations:

Screening form filled by: _____ Signature:_____ Date____

Verified by: _____ Signature:_____Date_____

Appendix 8 Terms of Reference for Initial Environmental Examination (IEE) of Sub-Projects under CEIP

Background

Bangladesh Water Development Board (BWDB) requires conducting Initial Environmental Examination (IEE) for first phase selected 17-20 coastal polders under CEIP project, as per the DOE and World Bank guideline. The IEE reports will be submitted to DOE for obtaining clearance as well as suggestions on further environmental impact assessment. The IEE study should be conducted according to following scope of works.

Objective

Main objective of the IEE study to identify possible environmental impacts and mitigation measures and preparing environmental management plan, which will help to implement the sub-projects in environmental friendly manner.

Scope of works

(i) Design and conduct environmental screening to collect the baseline information on the physical, biological and socioeconomic characteristics in each first phase selected 17-20 Coastal Polders. The baseline data collection should take into account the existing and proposed coastal polders rehabilitation in the area so that cumulative impacts can be assessed. The consultant will ensure that primary data and laboratory testing (for ex: soil testing, air quality, flora, fauna, etc.) are collected for the necessary parameters at all sites. Based on the field visit baseline data needs to be cross checked with secondary sources, if available. Include information on any changes anticipated before the project commences (e.g., water logging). This section should indicate the accuracy, reliability and sources of the data and consequences for assessing impacts and their mitigation;

(ii) Conduct detail public consultation in the polder areas with local NGOs, public, civil society and other relevant stakeholders;

(iii) Suggest mitigation measures to reduce negative impact including cumulative impacts, where appropriate, due to project location, and related to project design, construction, and operations. Potential environmental enhancement measures and additional considerations will also be covered;

(iv) Prepare a general environmental monitoring plan for the proposed polders which will describe the impacts to be monitored, and time, location and frequency of monitoring activities, and person/authority to carry out the activity. The tentative environmental monitoring and mitigation costs should also be described;

(v) Prepare an IEE report for each of the first phase selected polders. The report will incorporate the findings from Environmental Screening.

Structure of the IEE report

IEE report should be prepared as per following structure.

1. Executive Summary
2. Introduction: *This section will include (i) purpose of the report and (ii) extent of the IEE study.*
3. *Description of the Project: This section will provide a brief but clear picture about (i) type of project; (ii) category of Project; (iii) need for project; (iv) location (use maps showing general*

location, specific location, and project site); (v) size or magnitude of operation;(vi) proposed schedule for implementation)

4. Description of the Environment: *This section will provide sufficient information on the existing environmental resources in the area affected by the project, including the following:*

   (i) Physical Resources: (e.g. atmosphere (e.g. air quality and climate), topography and soils, surface water & groundwater, geology/seismology.

   (ii) Ecological Resources: (e.g. fisheries, aquatic biology, wildlife, forests, rare or endangered species, protected areas, coastal resources

   (iii) Economic Development: (e.g. industries, infrastructure facilities, transportation, land use, power sources and transmission, agricultural development, mineral development, and tourism facilities)

   (iv) Social and Cultural Resources: (e.g. population and communities (e.g. numbers, locations, composition, employment), health facilities, education facilities, socio-economic conditions (e.g. community structure, family structure, social well being), physical or cultural heritage, current use of lands and resources for traditional purposes by Indigenous Peoples, structures or sites that are of historical, archaeological, paleontological, or architectural significance.
5. Screening of Potential Environmental Impacts and Mitigation Measures: *Mitigation measures, where appropriate, will also be recommended to address environmental problems due to project location, and related to project design, construction, and operations as well as cumulative impacts of the project. Potential environmental enhancement measures and additional considerations will also be covered.*
6. Analysis of Alternatives: *This section will describe the alternative options of the project interventions and their impacts. Also the justification for selection of best alternative should be explained here.*
7. Institutional Requirements and Environmental Monitoring Plan: *The environmental monitoring plan will describe the impacts to be monitored, and when and where monitoring activities will be carried out, and who will carry them out. The environmental monitoring and mitigation costs should also be described.*
8. Public Consultation and Information Disclosure: *This section will describe the process undertaken to involve the public in project design and recommended measures for continuing public participation; summarize major comments received from beneficiaries.*
9. Findings and Recommendations: *This section will include an evaluation of the screening process and recommendation will whether significant environmental impacts exist needing further detailed study or EIA. If there is no need for further study, the IEE itself may need to be supplemented by an EMP. If an EIA is needed, then this section will include a brief terms of reference (TOR) for the needed follow-up EIA, including approximate descriptions of work tasks, professional skills required, time required, and estimated costs.*
10. Conclusions: *This section will discuss the result of the IEE and justification.*

Appendix 9 Terms of Reference for Environmental Impact Assessment (EIA) of Sub-Projects under CEIP

Background

Bangladesh Water Development Board (BWDB) requires to conduct Environmental Impact Assessment (EIA) study for first phase selected 5-7 coastal polders under CEIP, as per the DOE and World Bank guideline. The EIA reports will be submitted to DOE for obtaining environmental clearance. The EIA study should be conducted according to following scope of works.

Objective

The objective of the EIA study is assessment of environmental impacts and preparation of environmental management plan for implementing the sub-projects without harming the environment.

Scope of works

i) Carry out detail field investigation of required parameters of environmental and social baseline

ii) Determine the potential impacts due to the project through identification, analysis and evaluation on sensitive areas (natural habitats; sites of historic, cultural and conservation importance), settlements and villages/agricultural areas or any other identified Important Environmental and social Component (IESCs).

iii) Determine cumulative environmental impacts of the project that may occur inside and outside the project area.

iv) Distinguish between significant positive and negative impacts, direct and indirect impacts, immediate and long-term impacts, and unavoidable or irreversible impacts.

v) Identify feasible and cost effective mitigation measures for each impact predicted as above to reduce potentially significant adverse environmental impacts to acceptable levels.

vi) Determine the capital and recurrent costs of the measures, and institutional, training and monitoring requirements to effectively implement these measures. The Consultant is required to identify all significant changes likely to be generated by the project. These would include, but not be limited to, changes in the coastal erosion and accretion due to alteration of tidal currents, changing fish migration routes, destruction of local habitats, and water logging, etc.

vii) Consult with modeling consultants to establish conformity of the impact assessment with existing and ongoing mathematical model due to climate change developed by a number of reputed firms. The developed models may be available from the main consultant and implementing agency;

viii) Prepare (a) an estimate of economic costs of the environment damage and economic benefits from the direct positive impacts that the project is likely to cause, and (b) an estimate of financial costs on the mitigation and enhancement measures that the project is likely to require, and financial benefits, if any;

ix) Describe alternatives that were examined in the course of developing the proposed project and identify other alternatives that would achieve the same objectives. The concept of alternatives

extends to the siting and design, technology selection, rehabilitation/construction techniques and phasing, and operating and maintenance procedures. Compare alternatives in terms of potential environmental impacts, vulnerability, reliability, suitability under local conditions, and institutional, training, and monitoring requirements. When describing the impacts, indicate which are irreversible or unavoidable and which may be mitigated. To the extent possible, quantify the costs and benefits of each alternative, incorporating the estimated costs of any mitigating measures. Include the alternative of not constructing the project to demonstrate environmental conditions without it.

x) Identify the specific reciprocal impact of climate change and polder. Check the suggested polder height with respect to the SLR and high tide. The sub consultant will ensure that the design will minimize the negative impact on the environment due to polder rehabilitation activities. For example, adequate fish pass should be provided to ensure free movement of fish or drainage facility should be provided to avoid water logging in the surrounding area.

xi) Prepare separate EIA report for each selected polder (5-7 nos) at the first phase;

xii) Prepare a detailed Environmental Management Plans for each polder (5-7 for the first phase) along with the respective EIA separately to monitor the implementation of mitigating measures and the impacts of the project of other inputs (such as training and institutional strengthening) needed to conduct it during construction and operation. Include in the plan an estimate of capital and operating costs and a description of other inputs (such as training and institutional strengthening) needed to implement the plan.

xiii) Ensure to address Occupational health and safety for the construction workers in the EMP;

xiv) Develop Environmental monitoring format for regular monitoring of the project at the pre-construction, construction and operational stage;

Structure of the EIA report

EIA report should be prepared as per following structure.

1. Executive Summary
2. Introduction: *This section will include (i) purpose of the report and (ii) extent of the IEE study.*
3. Policy, Legal and Administrative Framework: *This section will describe relevant environmental policies, rules and administrative procedures that need to be followed for the proposed project.*
4. Description of the Project: *This section will provide a brief but clear picture about (i) type of project; (ii) category of Project; (iii) need for project; (iv) location (use maps showing general location, specific location, and project site); (v) size or magnitude of operation;(vi) proposed schedule for implementation)*
5. Methodology of EIA
6. Description of the Environmental Baseline: *This section will provide sufficient information on the existing environmental and social baseline resources in the area affected by the project, including the following:*

   (i) Physical Resources: (e.g. atmosphere (e.g. air quality and climate), topography and soils, surface water & groundwater, geology/seismology.

(ii) Ecological Resources: (e.g. fisheries, aquatic biology, wildlife, forests, rare or endangered species, protected areas, coastal resources

(iii) Economic Development: (e.g. industries, infrastructure facilities, transportation, land use, power sources and transmission, agricultural development, mineral development, and tourism facilities)

(iv) Social and Cultural Resources: (e.g. population and communities (e.g. numbers, locations, composition, employment), health facilities, education facilities, socio-economic conditions (e.g. community structure, family structure, social well being), physical or cultural heritage, current use of lands and resources for traditional purposes by Indigenous Peoples, structures or sites that are of historical, archaeological, paleontological, or architectural significance.

7. Potential Environmental Impacts: *Mitigation measures, where appropriate, will also be recommended to address environmental problems due to project location, and related to project design, construction, and operations as well as cumulative environmental impacts. Potential environmental enhancement measures and additional considerations will also be covered.*
8. Evaluation of impacts: *This section will describe economic, numeric or descriptive evaluation of impacts.*
9. Analysis of Alternatives: *This section will describe analysis of alternatives in terms of project location and technical designs and associated environmental impacts.*
10. Environmental Management Plan: *The environmental management plan (EMP) will include mitigation and enhancement plan, compensation and contingency plan as well as monitoring plan. The EMP should also include tentative cost of implementation of the plan. As sample guideline for preparing EMP is given in the following section.*
11. Public Consultation and Information Disclosure: *This section will describe the process undertaken to involve the public in project design and recommended measures for continuing public participation; summarize major comments received from beneficiaries.*
12. Conclusions and Recommendations: *This section will include conclusions and recommendations.*
13. List of References
14. Annexes:

    List of Environmental Assessment Preparers
    Records of Consultations (minutes and photographs)
    Data and Unpublished Reference Documents

Sample Guideline for Preparing Environment Management Plan

The Consultant is required to develop an Environmental Management Plan (EMP) consisting of a set of feasible and cost-effective mitigation measures and monitoring and institutional plan to prevent or reduce significant negative impacts to acceptable levels. This will include measures for emergency response to accidental events (e.g., fires, explosions), as appropriate. The Consultant will provide an estimation of the impacts and costs of the mitigation measures, and of the institutional and training requirements to implement them. In particular this would include:

Environmental Mitigation & Enhancement Measures: Recommend feasible and cost-effective measures to prevent or reduce significant negative impacts to acceptable levels. Apart from mitigation of the potential adverse impacts on the environmental components, the EMP shall identify opportunities that

exist for the enhancement of the environmental quality in the surrounding area. Residual impacts from the environmental measures shall also be clearly identified. The EMP shall include detailed specification, bill of quantities, execution drawings and contracting procedures for execution of the environmental mitigation and enhancement measures suggested, separate for pre-construction, construction and operation periods. In addition, the EMP shall include good practice guides related to construction and upkeep of plant and machinery. Responsibilities for execution and supervision of each of the mitigation and enhancement measures shall be specified in the EMP. A plan for continued consultation to be conducted during implementation stage of the project shall also be appended.

Capacity Building & Training: The EMPs shall describe the implementation arrangement needed for the project, especially the capacity building proposals including the staffing of the environment unit (as and when recommended) adequate to implement the environmental mitigation and enhancement measures. For each staff position recommended to be created, detailed job responsibilities shall be defined. Equipment and resources required for the environment unit shall be specified, and bill of quantities prepared. A training plan and schedule shall be prepared specifying the target groups for individual training programs, the content and mode of training. Training plans shall normally be made for the client agency (including the environmental unit), the supervision consultants and the contractors.

Supervision & Monitoring: Environmental monitoring plan will be an integral part of an EMP, which outlines the specific information to be collected for ensuring the environmental quality at different stages of project implementation. The parameters and their frequency of monitoring should be provided along with cost of the monitoring plan and institutional arrangements for conducting monitoring. Reporting formats should be provided along with a clear arrangement for reporting and talk corrective action. The EMP shall list all mandatory government clearance conditions, and the status of procuring clearances. Additionally, the EMPs shall include as separate attachments, if applicable, Natural Habitat Plan and/or Cultural Properties Plan to satisfy the requirements of the World Bank safeguard policies.

Appendix 10: Example Good Environmental Construction Guideline

The Environmental Guideline includes the important issues and factors to be considered during implementation of the project to avoid/ address environmental concerns through modifications in project design and incorporation of mitigation/ enhancement measures. The Guideline for the CEIP project is briefly outlined below, explaining major environmental and social concerns that need to be addressed in different stage of project implementation.

Guideline 1: Project Planning and Design

1.1 During planning and designing of the proposed interventions in the coastal polders, all possible alternative options should be considered and evaluated through multi-criteria analysis including environmental issues.
1.2 Construction of fish friendly structures like fish-pass instead of traditional structures
1.3 'Environmental friendly' and 'sustainable' structures should be incorporated in the project plan and design which can be implemented with available local technology and resources.
1.4 All stakeholders should be involved in planning and design stage. The preliminary plan and possible design of all options should be presented to stakeholders and get feedback from them.
1.5 There must be provision for changing/ modification of design, if any conflict/ environmental hazards during construction phase of project.

Guideline 2: Site selection and clearance

2.1 Sites for new structures (embankment/ regulators/ inlets/ closure dam) should be selected considering geographical, hydrological, technical, environmental and social issues.
2.2 Clearance should be taken from appropriate authorities (e.g. Local administrations, DLS, BIWTA) for the selected project sites.
2.3 'Site clearance' and 'Environmental clearance' for the project should be taken from the Department of Environment (DoE) by conducting 'Initial Environmental Examination (IEE)' and 'Environmental Impact Assessment (EIA)' for each sub-project of CEIP.
2.4 Clearance should be given from funding agencies to ensure that the environmental management measures are incorporated in the project according to the safeguard policies of the funding agencies

Guideline 3: Construction materials and camps

3.1 Construction materials (e.g. soil, concretes, and heavy machineries) should be collected from local market as much as possible.
3.2 Soils required for earthworks should be collected from fallow/ non-agricultural lands. Top soil of agricultural land should not be used.
3.3 Camps for labor and construction materials should be established in public land or borrowed private land with proper compensation.
3.4 Drainage channels, ponds, productive agriculture land, ponds, fish firms, forest land and ecologically sensitive areas should be avoided as much as possible.
3.5 Security of construction materials should be ensured in the camps.

Guideline 4: Rivers, drainage channels and wetlands

4.1 Alignment of rivers and drainage channels and area of wetlands should not be altered significantly due to the project interventions.
4.2 Re-excavation of drainage channels should facilitate sustainable navigation, storage of freshwater and maintaining connectivity of water bodies.

4.3 Erosion control and soil stabilization measures should be taken to maintain the embankments and to protect tidal flooding
4.4 Regulators/ sluices/ inlets should be designed and constructed in such a way that allows to maintain minimum dry season water flow in the rivers and drainage channels and wetlands. It will help survival of capture fisheries and other wild lives.
4.5 Fish friendly structures (e.g. fish-pass) should be constructed in the drainage channels. In other cases, openings of outlet structures should be made as wide as possible for relatively free movement of fishes during migration.
4.6 Alternative communication system (e.g. submersible road) can be developed in the wetlands.

Guideline 5: Pollution control and waste management
5.1 Solid waste and wastewater generated from workers camps during construction activities of the project should be dumped in selected sites.
5.2 Sediment management plan should be prepared before re-excavation of drainage channels.
5.3 Sediments drawn from channel re-excavation can be used in earth work of embankment raising or land filling within the project area as much as possible. Agriculture lands should be avoided for dumping sediments or other waste materials.
5.4 Direct onsite mixing of sediments and sludge, generated from channel re-excavation, with water in rivers or wetlands should be avoided. Otherwise, turbidity of water will be so high that whole aquatic ecosystem will be hampered.
5.6 Noise and air pollution from the transports and motor engines, used for construction activities, should be as low as possible.

Guideline 6: Agriculture and Fisheries
6.1 Since agriculture and fisheries sectors will be benefitted from the CEIP project, sustainable agriculture and fisheries practices (e.g. saline tolerant crops, shrimp-rice farming system, organic farming) should be promoted in the project area.
6.2 Support of DAE and DoF should be extended to promote sustainable agriculture and fisheries practices after completion of improvement works in CEIP.
6.3 Critical breeding areas of major fish species should be identified and declared as sanctuaries.
6.4 Fish migratory routes should be maintained.
6.5 Low cost irrigation technologies can be promoted.

Guideline 7: Ecosystem and biodiversity
7.1 Habitats of wild flora and fauna should not be disturbed by the project activities
7.2 Critical areas of ecological importance should be identified in the project area and declared as sanctuaries, if necessary.
7.3 Re-vegetation of barren surfaces of embankments and fallow lands should be encouraged.
7.4 Awareness should be created to reduce large amount of chemical fertilizer application in the project area. It may pollute water and soil and hamper the life cycle of aquatic species including fisheries.

Guideline 8: Stakeholder consultation
8.1 All stakeholders should be involved in project planning, design, implementation and post- project monitoring phase.
8.2 Community level stakeholders such as PAPs, Union Parishad, WMOs, NGOs should be involved, with appropriate benefit/ remuneration, in operation and maintenance of the structures in coastal polders.
8.3 Conflict resolution mechanism should be developed.
8.4 Education and awareness program need to be extended to make people aware about the positive and negative impacts of CEIP so that people initiate sustainable economic activities.
8.5 Locally available accessible print and electronic media should be used to make people aware about the project activities.

Guideline 9: Health and safety of public and worker's

9.1 A health and safety plan should be developed to address issues of public and worker's.
9.2 Appropriate warning signs, notification and public hearing should be done to avoid any accident.
9.3 Adequate emergency equipments for health injury, fire fighting and rescue operation should be kept in the construction camps.

Guideline 10: Compensation and contingency

10.1 Appropriate compensation and contingency plan should be developed and fund should be allocated.
10.2 Compensation for lands, crops, trees, fish and other structure should be given to the affected parties.
10.3 Disputes among the project affected parties and compensation payments should be resolved by Grievance Redress Committee.
10.4 Contingency fund should be provided to the affected parties due to accidental injuries or damages.

Guideline 11: Environmental monitoring and audit

11.1 A comprehensive monitoring plan should be developed for monitoring environmental and social components during construction and post-construction period of CEIP project.
11.2 The following environmental and social components should be monitored:

- Surface water flow in river channels and drainage
- Groundwater level
- Soil and water quality (e.g. pH, salinity, SPM, DO)
- sedimentation
- flood and salinity free landuse for shrimp farming or other use
- Crop and fish production
- Migratory fish species
- Mangrove health (fruiting and flowering)
- Dolphin activities (Surfacing, diving, migration)
- Biodiversity (flora and fauna), Species composition and richness
- Conflict of interest among stakeholders
- Quality of life indicators (e.g. income level, calorie intake, education, health)

11.3 Relevant stakeholders from national to local level should be involved in the monitoring process.
11.4 Environmental auditing can be performed by consultant, who is not directly involved in implementing the project, during construction and post-construction phase of the CEIP.

Guideline 12: Monitoring Indicator

Criterion	**Indicator**
Habitat loss	▪ Area of wetlands ▪ Area of swamp forest
Biodiversity	▪ Number of fish species ▪ Number of amphibians ▪ Number of bird species ▪ Number of wild mammals ▪ Number of crop species grown ▪ Number of "life support plants" ▪ Number of medicinal plants
Fish Migration route	▪ Visual inspection of closure ▪ Fish catch ▪ Number of fish species caught

Water logging	▪ Area of inundation ▪ Duration of inundation
Siltation	▪ Percent of silted up channels ▪ Percent of agricultural land affected by deposition of sand
Impact on drinking water	▪ Number of dry tube wells ▪ Number of dried up ponds ▪ Number of households affected
Water Pollution	▪ Amount of pesticide use per ha for HYV rice (average consensus) ▪ Percent of households with pit / sanitary latrines ▪ Area affected by salinity

Appendix 11: Participants & Photographs of meeting, workshop and baseline survey

List of participants in the stakeholder consultation workshops

Four Stakeholder Consultation Workshops were held in the coastal area to get feedback on the proposed project interventions and possible environmental and social impacts and required its mitigation/enhancement measures. The schedule of workshops is given below.

Sl. No	Place	Date	Total number participants
1	Upazila Hall room, Chakaria, Cox's Bazar (Polder - 66/4 and neighboring area)	19 December, 2011	42
2	Upazila Hall room, Ramgati, Lakshmipur (Polder - 59/2 and neighboring area)	21 December, 2011	42
3	Upazila Hall room, Dacope, Khulna (Polder – 32 and neighboring area)	26 December, 2011	37
4	Upazila Hall room, Barguna Sadar, Barguna (Polder – 41/1 and neighboring area)	28 December, 2011	44

The following type and number of participants attended the workshops.

Sl. No.	Type of participants	Chakaria, Cox's bazar	Ramgati, Lakhsmipur	Dacope, Khulna	Barguna sadar, Barguna
1	Upazila Nirbahi Officer (UNO)	1	1	0	1
2	Upazila chairmen	1	1	1	1
3	Upazila vice- chairmen(Male)	1	1	1	0
4	Upazila vice- chairmen(Feale)	1	1	1	1
5	UP Chairmen	4	4	1	2
6	Ex-Up chairman	1	0	2	0
7	UP member (Male)	5	8	5	8
8	UP member (Female)	3	3	1	5
9	UP Sachib (secretary)	0	1	1	2
10	BWDB representative(SDE/SO)	0	0	1	3
11	AC(Land)	0	0	0	2
12	Upazila Education officer	0	0	0	2
13	Upazila Agriculture officer / Sub Assistant Agriculture officer	1	1	1	2
14	Upazila Livestock officer	1	1	1	1
15	Upazila Engineer (LGED)	0	0	1	1
16	Upazila Fishery officer	1	1	1	1
17	Upazila Public health officer	0	0	0	1
18	Upazila Anser VDP officer	0	0	1	0
19	Project Implementation Officer (PIO)	1	2	0	0
20	Teacher	0	3	2	1
21	Journalist	6	2	2	1
22	Politician	2	2	2	1
23	Fishermen	2	1	1	2

Sl. No.	Type of participants	Chakaria, Cox's bazar	Ramgati, Lakhsmipur	Dacope, Khulna	Barguna sadar, Barguna
24	Fish trader	0	0	1	0
25	Farmer (agriculture)	5	2	3	2
26	Fish farmer	2	2	0	0
27	Gher owner	0	0	1	0
28	NGO representative	1	1	2	0
29	Elite person/civil society	0	0	2	1
30	Others	3	4	2	3
	Total	**42**	**42**	**37**	**44**

List of participants are attached after Appendix - 11.

	
Consultation meeting with Team Leader of CEIP	Stakeholder workshop in Chakaria, Cox's Bazar
	
View of participants of workshop, Chakaria, Cox's Bazar	Collecting comments and suggestion from the participant during workshop
	
View of participants of workshop, Dacope, Khulna	Stakeholder workshop in Ramgati, Lakhsmipur

	
Stakeholder workshop in Barguna Sadar	Open discussion in the workshop at Ramgati, Lakhsmipur
	
View of participants of workshop, Barguna Sadar	Focus group discussion at Nudmulla UP office, Pirojpur
	
Focus group discussion at Nudmulla UP office, Pirojpur	PRA at Bogi polder-35/1, Bagerhat

	
Discussion with fishermen at polder-35/1, Bagerhat	Discussion with the local people at polder-32, Khulna
	
View of PRA at polder-32 , Khulna	Consultation meeting with local elites at polder-32, Khulna
	
Consultation to stakeholders at polder-32, Khulna	PRA at Bogi polder-35/1, Bagerhat